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Co-operation with the Isolated Plant

That the isolated plant can and should become the central station's most valuable off-season customer is no longer an untried theory. Progressive central-station managers know from experience that during the summer months when the lighting load on their systems is at its minimum, and when isolated plants operate at a disadvantage by reason of the absence of their steam-heating demand as well as the high cost of labor per kilowatt-hour generated, little difficulty is encountered in obtaining the isolated-plant load on a paying basis. Just why more isolated-plant owners and central-station managers do not enter into the above-mentioned co-operative scheme is not apparent, unless, perhaps, some central-station managers may hold the unenlightened selfish view that they would be giving valuable aid to competitors. The fact of the matter is that with the approach of the winter lighting peak the central station will have little to regret when relieved of the isolated-plant load, which would then be somewhat of a burden rather than wholly a benefit. During the summer months progressive central-station managers can help themselves by giving welcomed aid to isolated-plant owners without regard to any possibility of continuing the service throughout the winter.

Pennsylvania Utilities Law

The public utilities act very recently passed by the Pennsylvania Legislature and likely at any moment to be signed by Gov. Tener is unusually comprehensive in its phraseology, occupying about 100 pages and containing some 30,000 words. The control given the commission over municipal utilities is limited and relates to accounting and reports, to certificates of public convenience and necessity in the case of new municipal utilities, and to approval of contracts between public service companies and municipalities. In this respect the new law, although not ideal, at least protects the companies already serving the public from needless or wasteful competition and duplication of investment, which is more than can be said of the new Illinois law. On the other hand it leaves the public at the entire mercy of municipal authorities as regards the rates, regulations and service of such municipal utilities as now may be operating or in the future may be created. Nor does the law protect those companies now competing with municipal plants from the harmful and unfair competition of municipal rates so low as to be unremunerative, or from lower rates which are remunerative to the city only because the service rendered to the public is inferior. In common with some other recent laws of this kind the Pennsylvania act empowers public service companies: "To establish with the consent of the commission a scale of charges subject to automatic adjustment in relation to the dividends to be paid to the stockholders." This recognizes the plea advanced that capital will not be attracted to public utility investments by a return say, of 7 per cent, indefinitely, but demands a further increment of profit as a reward for progressive management and for introducing new economies as soon as the advances of the arts bring them forward. That is to say, capital asks the public to share with it the savings resulting from improved economy, as an incentive toward such economy. This brings up, of course, a proposition which is debatable from the standpoint of public policy. The real question is whether a public utility owes it to the public to give the most progressive and economical management obtainable, in return for a dividend of 7 or 8 per cent, for example, or whether it owes something less and may fairly ask for a further profit as a premium on maximum efficiency. So many variables enter this problem that space prevents elaboration of it here. Public opinion may be counted upon to decide the question ultimately, but in the meantime great interest attaches itself to the courses to be adopted by commissions. The Pennsylvania law is noteworthy in respect to the very strong control given the commission over railroad crossings, at grade, or above or below, and to the crossings of pole or transmission lines of every character, either at railroads or with reference to each other. Economy in state expenditure is promoted by abolishing the railroad commission, but the new commission is an unusually large body, comprising seven members. However, within the state there is much railroad property, including important trunk lines, besides numerous street and interurban railroads, pipe lines and a great number of public utility companies of diverse kinds.

Utilization of Electrolytic Iron

Many of the advantages attending the use of electrolytic iron as the active magnetic material for electrical machinery were set forth in a paper by Dr. Max Breslauer in a recent issue of the *Elektrotechnische Zeitschrift*, as noted elsewhere in our Digest. Chemically considered the characteristic feature of electrolytic iron is its freedom from carbon. Magnetically it possesses higher permeability and lower hysteresis loss than do the so-called alloy steel sheets used in transformer and dynamo-electric machinery. It is noteworthy in this connection that pure electrolytic iron is not a new product. It was produced on a relatively large scale by Prof. C. F. Burgess, of the University of Wisconsin, about ten years ago. Moreover, Professor Burgess is to be credited with extensive investigations of the properties of alloys of electrolytic iron and other metals.

The Unqualified Commissioner

A careful analysis of conditions surrounding the work of a public service commissioner brings to light adequate reasons for condemning the recent appointment to the New York Commission by Governor Sulzer of a man who has been a locomotive engineer for the past twenty years. Certainly no one can object to the appointment merely because the man is a locomotive engineer. It is a serious question, however, if one who has been doing little else than running an engine back and forth in a limited territory for anything like a period of twenty years can possibly have had a sufficient variety of experience to make a good commissioner. His moral qualifications may be of the best, his mentality may be of a high order, and, as a citizen, he may be everything that could be asked. These would make him merely fit to be a commissioner; they would not prepare him for the work.

The activities of a public service commissioner are very extensive and of great variety. He is not a judge controlled by technical rules of evidence, but must conduct hearings at which important evidence is often recorded; much harm may be done, or time wasted if he is unable to determine what is incompetent, immaterial and irrelevant. He is called upon to decide as to the reasonableness of demands made by the public, or of requirements insisted upon by corporations, and a broad general knowledge of affairs coupled with ripe judgment will be required to derive proper conclusions. Decisions of the public service commission involve questions of law, engineering, and business. No commissioner can be sufficiently informed in these divisions of the world's activity to enable him to be independent of other commissioners. He is dependent partly upon the opinions of subordinates, partly upon the statements of interested parties before him, and partly upon the opinions of his fellow commissioners, often very conflicting, or at least confusing. Again the value of his decision, not only as to the material submitted, but also as to the men submitting it, will depend largely upon the breadth of his experience.

We cannot assert that the appointee from a locomotive cab has not all the above qualifications, but we do submit that, as a rule, he could not be expected to have them. The very narrow groove in which he has worked so long has provided no opportunity for him to cultivate them. There are many lawyers, engineers, and business men who, on account of a narrow experience, we should consider just as unavailable as the present appointee. Nevertheless, as a rule, men of the last mentioned class have opportunities to view affairs at many angles and, therefore, can be expected to have the needed qualifications.

A practical railroad man was specified in the political platform, but it must be assumed that a practical man, in the general sense, was meant. If the appointee had started as a locomotive engineer, or even much lower, and had progressed through various departments, so that he could be expected to have some grasp of general railroad business, and especially of the intricate relations existing between a public service corporation and the public, we should be hopeful, in the highest degree, of his appointment. No matter what his standing as a man and as a citizen may be, we regard it as most unwise to permit him, or anyone else of his limited experience, to have a part in wielding the great power given by the public service commission law of New York State.

A Vertical Trunk Line

In another column Mr. Charles E. Knox gives a most instructive account of the special problems encountered in providing the gigantic Woolworth Building with adequate elevator service. A modern office building is a metropolis quite by itself, and its efficiency as a place of doing business depends in no inconsiderable degree on the character of the elevator service. The Woolworth Building is not only of very exceptional size as regards office capacity, but its tower, the highest building in the world, involves difficulties all its own. As in the case of the suburban service of a great city, express trains to the further districts are necessary, and the whole transportation traffic must be managed with special regard to the convenience of the population.

From a mere mechanical standpoint the elevators in the Woolworth Building are rather in a class by themselves. In the first place their number, twenty-six, is unusually great, and their service, from the enormous height of the central tower, is altogether peculiar. They are of the electric type with the motor armature connected directly to the driving sheave. On the armature shaft is mounted a large brake pulley with a pair of brake shoes forced against it by powerful springs except when current to the motor energizes the brake magnets and releases the shoes. If anything happens to the motor, therefore, the brakes take hold automatically and stop the car. The drive is thus very simple and the actual moving force is supplied by two half-turns of the running rope between counterweight and car over the driving sheave by way of an idler sheave placed beneath it. This particular arrangement is especially safe against over travel of the car or the counterweight. The speed of the elevators in this building is 700 ft. per minute, the highest speed yet regularly used on passenger elevators, although curiously enough the top speed of the motor is only about 68 r.p.m., as extraordinary for an electric motor as is the rising speed for an elevator. The safety devices applied are most ingenious and effective.

The most interesting and novel feature of the whole equipment is the train-dispatching system. In ordinary elevator service a starter on the ground floor uses his judgment and tries to keep the equipment going to the best advantage, but inasmuch as he loses touch with the elevator when once it is on its way, the control, while good enough for a low building, is not sufficiently effective for dealing with the modern skyscraper, much less with the extremely high Woolworth Building. In this building the operation of the car is placed in the hands of a dispatcher with an office on the second floor overlooking the group of elevators. Each elevator is connected to a lamp indicator with a lamp for each floor lighted as the car passes that floor. Consequently a glance at the lamp indicator gives the dispatcher an im-

mediate view of the position of each car of the entire system. He also knows when, where, and for how long, each car stops. In case the schedule is violated a signal can be immediately sent to the operator to omit stops at certain floors. A set of switches enable the dispatcher to cut out or transfer the floor signals for any car so that if the car gets behind its schedule it will not be signaled until it has caught up, the floor signals being transferred to another car. In each car there is a telephone with a megaphone so that the dispatcher can deliver orders directly to the operator and keep the system properly moving. These are only some of the many details of this unique train-dispatching system. By its use the dispatcher can keep in closer touch with the operator than a train dispatcher can with the engineers on a suburban system. The result must be a great improvement in the orderly and effective carrying of passengers, which is indispensable in a well-served building.

The Standardization of Head-Lamps

A brief paper by Messrs. L. C. Porter and K. M. Mackall brings to the front the question of electrical head-lamps on locomotives, now of unusual importance on account of legislation regarding the subject. Eight states have in force laws regarding the head-lamps which shall be used within their territory, and bills are pending in several other states. The whole question seems somewhat unsettled on account of very grave doubts as to whether on the whole electric head-lamps of great power are really advantageous. This question is one often discussed regarding the head-lamps for automobiles and street cars. There is no doubt that for service on a perfectly clear night and on a straight track use can be made of a lamp powerful enough to illuminate distant objects on the track before they come within the dangerous space of the train. Every moving vehicle may be conceived as carrying ahead of it a danger stretch equal to the distance required to reach a full stop. That dangerous space depends on the speed and weight of the train and on the available brake power, but it is in nearly all cases much longer than would ordinarily be supposed. Some recent accidents may very likely be traced to the fact that the danger distance for a modern fast and heavy train is considerably longer than that for which the signals actually in use are adopted. A long-range signal lamp is of small avail on a curve unless the beam is so wide that its radius will fully take up the distance between the tangent at the head-lamp and the rails measured at the extreme length of the danger distance. There is also chance of obliterating the light from the present signal lamps which are of low power, by the glare of the head-lamps. However this may be, the question is not one to be decided offhand; it is perfectly certain that a mere specification of the candle-power of the bare source used in the head-lamp such as appears in some of the statutes is perfectly useless.

In their article in this issue Messrs. Porter and Mackall suggest, very properly, that the average beam candle-power at a specific distance over a specific angle be made the criterion of the effectiveness of the light. This is more to the point, but we are inclined to think that the further suggestion that the distance should be not less than 500 ft. and the spread 2.0 deg. is not altogether happy. What one really wants to know about the head-lamp is what the illumination produced is over the necessary area at a distance approximating the danger distance of the train. In other words, the problem is to supply enough light at a point beyond the danger distance to render objects on the track visible. The spread of the beam must be great enough at this distance to allow for curvature of the track, otherwise the beam will not fall upon the track until a point has been reached perhaps far within the danger distance. The matter needs standardization and ought to be taken up by some distinctively railway body. Specifications drawn up by petty-fogging legislators are of very little use in solving technical problems.

Peace and Publicity

On the other side of the Canadian boundary there is in operation a simple and effective plan for bringing about settlements of labor disputes. When a controversy arises between employers and employed both are required to make a public statement of all the facts in the case. The interval gives time for angry spirits to subside and for the contestants to consider soberly whether the issues at stake are worth fighting for or not and to arrange a basis of agreement if such is possible. Meanwhile the public has an opportunity to review the facts and pass upon the merits of the case. This public inspection alone is likely to bring about a compromise, because neither side will wish to enter or continue a contest without public approval. So significant is this principle of full publicity in bringing about adjustment of controversies that Mr. Bryan, the Secretary of State, now even proposes to apply it on a world-scale by writing into our treaties with foreign nations the agreement that before any civilized warfare can be declared, a period of international investigation and conferences must first elapse.

In the distinguished examples just cited the various branches of the electrical industry should find a lesson for the settlement of their own disagreements. When due to trade disagreements, contractors, dealers and central station are engaged in a controversy of obstruction and attack, the most direct method of clearing up the situation is to have an honest statement prepared setting forth the claims of both sides. If such a review can be prepared by an outside, unbiased student of local conditions, and is of such a character when finished that it has the approval and respect of both sides as an honest statement of facts, surely a long step will have been taken toward settlement of the local misunderstanding. With the situation thus crystallized and held up to the view of the contestants and their friends in the industry and public, both sides will likely see where they have erred and will gain for the first time a conception of the other fellow's claims to justice. Most disputes have their birth in misunderstanding by each side of the facts as viewed by the other. Knowledge of the other side's viewpoint practically always means death to the controversy.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

High-Efficiency Incandescent Lamp

As a result of investigations made in the research laboratory of the General Electric Company at Schenectady, N. Y., for the past few years there has been produced a metallic-filament lamp which operates at the low specific consumption of 0.5 watt per candle—the efficiency being about twice that of the best incandescent lamps heretofore available. The new lamp contains a specially shaped tungsten filament and is filled with an inert gas, such as nitrogen, at a pressure of about an atmosphere. The types which it is expected to develop first are adapted to comparatively high current consumption, 6 amp. and above. The new lamps promise to be of particular value in a field not heretofore covered by incandescent lamps, and should greatly broaden the applications in which they can be used advantageously, particularly in the direction of very large candle-power units.

I. E. S. Survey of Lighting Conditions

As president of the Illuminating Engineering Society, Mr. Preston S. Millar is submitting to the numerous industries in the lighting field a series of questions in order to obtain information regarding lighting practice as well as to making available comprehensive and accurate data to constitute a record of the status of the illuminating art in 1913. The questions asked occupy sixteen sheets and cover the practices of central stations, store keepers, sign makers, gas companies, manufacturers of lighting auxiliaries, school authorities, ophthalmologists and railway companies. The data compiled will be incorporated in a paper to be presented before the Illuminating Engineering Society and distributed to all those co-operating in its compilation.

Research Bureau Established at Boston "Tech"

A division of electrical engineering research has been established at the Massachusetts Institute of Technology, following a grant of $10,000 per year for five years from the American Telephone & Telegraph Company. This award came through the initiative of President Vail, of the latter organization, who presented the Institute about a year ago with the Dering electrical library of more than 30,000 titles. Taking into account the value of the library itself, there are now available for electrical work gifts and pledges of more than $200,000. The laboratory of the division is already in commission under the direction of Dr. Harold Pender, who has been named as director of the bureau, Mr. H. F. Thomson being secretary and assistant to the former. The staff will be developed as becomes necessary, and an advisory committee has been named by the Institute, consisting of Prof. Dugald C. Jackson, head of the department of electrical engineering, and Professors F. A. Laws, R. R. Lawrence and W. E. Wickenden.

Among the problems which are to be undertaken this summer are a study of the clearness of speech in the telephone, investigating the phase relations of harmonics in sound waves, a study of skin effect in alternating-current transmission, and a determination of the distance to which a street-car passenger can be carried with reasonable profit on a 5-cent fare. The work of the bureau is in no sense contemplated as an outlet for the surplus energy of students, but it will conduct researches along liberal lines and in fields of industrial importance. In large measure the development of the organization is an outgrowth of the successful researches carried on in the past two years in the field of motor-vehicle transportation by the electrical engineering department.

Winnipeg's Municipal Plant Shows $53,025 Deficit

The report for the first fiscal year of the Winnipeg municipal plant, ending April 30, 1913, has been filed with the local utilities commission and shows a deficit of $53,024.88 for the twelve months. It is pointed out, however, that the plant commenced actual earning only last September and that other delays occurred in connecting up offered business. The total operating earnings of the power department for the fiscal year amounted to $475,509.57. Total charges in the same year, including interest on stock and debentures, sinking fund and an allowance of $52,862 for depreciation, amount to $529,442.60. The revenue deficit for the year is therefore $53,024.88.

Permit for Pacific Hydroelectric System

On July 16, Secretary Houston, of the Department of Agriculture, issued a permit to the Pacific Light & Power Corporation, Los Angeles, Cal., to construct and operate a series of power plants in the Sierra National Forest. The company plans to build four power houses, two reservoirs, and 25 miles of cement-lined tunnels. On account of the magnitude of the construction work and the amount of power to be disposed of, the permit provides for a construction extending over a period of twelve years. Under a temporary permit the company has already nearly completed the first step of this development, known as the "Big Creek Project," the work of construction being done by the Stone & Webster Engineering Corporation.

The ultimate development proposed is about 150,000 hp. The greater part of the energy will be transmitted 240 miles into Los Angeles and vicinity and will probably be used in large part on further extensions of interurban railway systems. It is also expected that considerable quantities of energy will be utilized in pumping water for irrigation in the upper San Joaquin Valley. The energy will be transmitted over a double-steel-tower line strung with stranded aluminum cables operated at a pressure of 150,000 volts.

This development of the Pacific Light & Power Corporation is one of several under way or projected upon national forest lands in California. Among these are the projects of the Great Western Power Company on the north fork of the Feather River, where a reservoir of 43 sq. miles is to be constructed and power plants with a total rating of about 350,000 hp are to be built. The Southern California Edison Company is planning for the erection of four plants on the Kern River. The Pacific Gas & Electric Company is constructing on the South Yuba one of the highest masonry dams in the world. The greatest water-power development in the history of the state is now under way and most of the plants proposed or being constructed will occupy national forest lands under permit from the Secretary of Agriculture.

Retaining Business of Dissatisfied Customers

has seemed to be that of taking men with the requisite

Ohio Electric Light Association at Cedar Point

(By Telegraph)

Cedar Point, Ohio, on Lake Erie, served both as convention headquarters and as a summer resort for the delegates who attended the nineteenth annual meeting of the Ohio Electric Light Association held at the Breakers Hotel, July 15, 16, 17 and 18.

The first session was called to order Tuesday morning by Mr. J. C. Martin, of Wilmington, president of the association. In the absence of Vice-president J. D. Lyon, Cincinnati, who has assumed other duties, Mr. W. C. Anderson, of Canton, a past-president, occupied the chair while Mr. Martin delivered his presidential address.

President Martin's Address

Mr. Martin spoke of the growth of the association, saying that at present its enrollment includes 102 active and 90 associate members, representing 65 per cent of the privately owned plants in Ohio. Among the many plants which suffered from the floods recently, Dayton was probably the most seriously affected, yet by the generous aid received from the New York and Chicago companies its central stations were in operation furnishing energy within forty-eight hours after the water had receded. As a plan for future flood protection, President Martin spoke of the project of establishing large reservoirs near the headwaters of the rivers of the State, thus holding the water in check during rainy seasons and furnishing an opportunity for hydroelectric development during dry seasons.

Calling attention to the various matters brought to the consideration of the advisory committee during the last session of the Legislature, the president spoke of the work done in causing a redraft of the Mills bill governing public utilities. The committee's labors did not cease here, but sufficient opposition was instigated by its efforts so that the acts relating to the creation of local commissions, preventing the defense of contributory negligence, and covering workmen's compensation were all considerably modified.

As the Ohio companies will soon meet the proposition of a physical valuation of all properties in the state, Mr. Martin said that the advisory committee could be of considerable benefit to the members if sufficiently advised by the engineering departments of the larger engineering companies. In future decisions affecting the public utilities, the authority will probably rest in the public-service commission so that mutual aid should be furnished by the companies in getting fundamental questions properly decided. For this reason legal matters should be regarded as association problems rather than as merely local matters.

With these purposes in view, Mr. Martin said that it is now proposed that a monthly bulletin be published by the association. During ten months of the year questions of vital importance to the members would be published, and during the remaining two months information regarding rates and street-lighting contracts would be printed.

Mr. Martin also suggested that a legal body be appointed by the association to discuss matters jointly with the public-service commission. This body should receive advice from and co-operate with the public-utility corporations in the state.

Discussion and Business Topics

In closing President Martin spoke in commendatory terms of the services rendered by the secretary-treasurer, Mr. D. L. Gaskill, Greenville, Ohio, and by the various committees. Desiring that his address should express the sentiment of the association he then called for a discussion.

Among those who spoke were: Messrs. W. Parsons, of Springfield; D. L. Gaskill, of Greenville; C. I. Crippen, of Youngstown; L. Beecher, of Hillsboro; W. C. Anderson, of Canton; J. E. Miller, of Cleveland, and Samuel Scovil, of Cleveland.

Mr. Gaskill moved that a committee of five be appointed to devise the best plan to handle legal affairs with the public-service commission and to report at the 1914 convention. Messrs. Crippen and Beecher raised the argument that the report should be made sooner. Mr. Martin then suggested that the executive committee prepare a report on the subject and be ready to submit it before the next convention, provided conditions require it. Revaluation of property appeals should have prompt attention. Mr. Miller amended the motion so as to place the duty on the executive committee, as proposed, and the amended motion was carried.

Following this discussion, the secretary-treasurer, Mr. Gaskill, presented his report, in which he gave the revenues and disbursements for the year. As the active membership dues have never been changed since 1895, although the benefits to be derived from the association have increased considerably since then, Mr. Gaskill proposed a revision in the dues to provide for increased expenses. At present the dues vary from $5 to $10 yearly, according to the size of the town represented. The proposed schedule provides for a range from $5 to $50 per year, assessed as before. The matter was referred to the finance committee.

The executive committee recommended the institution of a monthly bulletin to contain decisions on public utility questions, lighting rates and similar subjects. Action on this matter was deferred until a later session. The committee also recommended that companies operating in several cities or towns should have active members in each. In addition, it was suggested that men in the electrical engineering profession or in the position of instructors in the science should be eligible to membership.

Report of Insurance Committee

The insurance committee next submitted a very comprehensive report, describing how its members had met with the Ohio Inspectors' Bureau and complained that fire-insurance rates were too high. The answer received was that any change would have to originate in the National Board of Fire Underwriters. In a subsequent investigation it was found that of sixty-five companies in Ohio, twenty-seven carried no insurance, and thirty-eight carried $2,373,250 insurance, on which they paid $23,382 in premiums annually. The total losses for these companies in five years aggregated $672, an amount barely one-half of one per cent of the premiums paid during that time. These figures show that central stations are very good risks.

At a meeting in Cincinnati, June 13, the committee suggested that the State of Ohio appoint an insurance commission which should review and correct rates by insurance companies on complaint or on its own initiative. Investigation also showed that inter-insurance with exchange of risk was a very satisfactory form.

In discussing the report Mr. Martin said that Ohio has three rating bureaus, one in each of the cities of Cleveland, Cincinnati and Columbus. One of these bureaus, it is asserted, is paid $70,000 annually for up-keep by the insurance companies, with the stipulation that a certain rate is to be maintained and that all insurance companies in the state are to abide by it. When attacked for high rates, the insurance companies refer the plaintiff to the rating bureau, saying that it sets the rates and they cannot be varied from.

Mr. M. E. Turner, Cleveland, reported that the committee on N. E. L. A. affiliation, of which he is a member, feels that the association is not yet ready to merge with the National Electric Light Association. The report was adopted.

In the evening a musicale and ball were held in the hotel lobby. During the intermission Mr. M. E. Turner, Cleveland, gave an address and demonstration of "Cooking by Unity-Load-Factor Electric Ranges," which was attended by a large audience of members and their wives.

On Wednesday morning at 10 o'clock the commercial session was opened with Mr. W. C. Anderson in the chair, the papers being presented in abstract by their authors.

warm the cold, raw water, one of these sterilizers treats Cincinnati were Messrs. C. J. Drees, Little Rock, Ark.;

Retaining Business of Dissatisfied Customers

In his paper entitled "The Retention of Business of Dissatisfied Customers" Mr. Thomas F. Kelley, sales manager for the Dayton Power & Light Company, urged above all else prompt and courteous attention to customers' grievances in order to prevent possible dissatisfaction. Especially should courtesy be insisted on from those employees who come in contact with the public. Where a complaint has been filed and the meter found correct, the case may be well turned over to some competent person to study the customer's conditions and determine whether changes cannot be made to reduce energy costs, thus transforming a dissatisfied complainant into a satisfied customer. A personal conversation is always preferable in explaining to the customer the inspector's finding. Poor lighting and delay in furnishing service are two other great sources of dissatisfaction. If the central-station man will only take the customer's viewpoint, the applicant will be very sure to receive more prompt attention. One cause of delay is the practice of requiring contracts and deposits in advance of supplying service. Such policies, declared Mr. Kelley, result in discomfiture of the customer and lost revenue for the company.

Discussion

Mr. Martin opened the discussion by saying that "Old business should be the best booster for new business."

Those who followed him in the discussion were Messrs. W. Parsons, of Springfield; C. C. Welch, of Columbus; W. C. Anderson, of Canton; S. M. Rust, of Greenville; J. M. Anderson, of Greenville; F. M. Tait, of Dayton; J. E. North, of Springfield; J. C. Martin, of Wilmington; Samuel Scovil, of Cleveland, and E. A. Bechstein, of Sandusky.

Mr. Parsons did not agree with Mr. Kelley in the matter of taking telephone messages as applications for service. In Springfield, he said, they have devised a system whereby a customer can be connected up twenty-four hours after application. He believes that credit is the mainstay of public utilities. Mr. Welch indorsed this opinion, saying that the credit of the applicant can best be judged by the solicitor, and other means should be devised to replace telephone applications, as they mean a distinct loss to business.

Mr. W. C. Anderson recommended that applications be taken by telephone, but that immediately thereafter a solicitor be sent to secure the application in writing so that no delay may result from lack of information on the status of the applicant.

Mr. Rust said that above all things favors should not be shown, as more will be offended by such practice than by a fixed rule requiring a guarantee or report with each application.

Mr. Parsons favored extending credit to those who have been in good standing in the past, in preference to any system requiring guarantees or deposits. He said that only about one-tenth of one per cent has to be charged off the books due to bad credits.

Mr. Martin recommended the system suggested at the N. E. L. A. convention in Chicago, whereby cities are divided into districts, each having a supervisor to look after the status of applicants. With such information and by not allowing back accounts to exceed the monthly bill the percentage of loss would be small.

Mr. Bechstein said that he believed in fixed rules and favored the payment of deposits with each application, interest on which can be paid at the rate of 6 per cent.

New Business

Mr. J. E. North's paper described particularly the practices and policies obtaining in his own department at Springfield, Ohio, where commercial development is furthered through the three agencies of solicitation, advertising, and association of satisfied customers. The selection of competent salesmen has been a problem, but the best plan has seemed to be that of taking men with the requisite selling ability and teaching them the technical requirements of central-station work. Early in his commercial career the new solicitor must be impressed with the fact that people are more interested in saving dollars than in discussing kilowatt-hours or kilovolt-amperes. The customer's knowledge of electrical terms can well come later of his own natural curiosity after the contract is signed. Solicitors' reports should be made as brief as possible, to avoid burdening the men with office duties. Simple forms are used by the Springfield company for this purpose, but at the end of each week results are collected and totaled, ready for comparison. In authorizing extensions bona-fide applicants are assured by asking prospective customers to agree to pay $1.50 monthly for the interval between completion of the extension and their contract for service. An aggressive campaign for motor business in Springfield has netted good results. Several large jobs have been acquired as the result of prompt aid in gas-engine accidents. The cases of prospective motor-service users are recorded on special blank forms which make available a record of all essential facts in connection with future electrification. Every department of the company is required to co-operate in affording to customers prompt service and courteous attention. Mr. North advised adjustment of rates to meet competing conditions, depending upon quantity of business rather than return from high rates.

Discussion

In concluding the abstract of his paper Mr. North suggested appointing a committee on new business to compile data on industries having electrical applications in order that prospective customers might be taken to visit such installations.

In the discussion which followed Messrs. T. F. Kelley of Dayton, M. E. Turner of Cleveland, J. E. North of Springfield, E. A. Elliott of Mount Vernon, George Edgar of Coshocton, W. T. Edgenson, Jr., of Alliance, and Samuel Scovil of Cleveland took part.

Mr. Kelley favored holding morning meetings at which salesmen can discuss methods of securing new business. He also expressed belief that where forms are kept showing equipment of manufacturers on service lines it is advisable to record the customer's individual "hobby," since by consulting this record it would be an easy matter for the solicitor to obtain a hearing from the customer, opening the way with the customer's favorite subject.

Mr. Kelley made a motion, which was passed, that a committee be appointed to compile data on new business enterprises. Mr. Turner and others disagreed with him, however, concerning the idea of bringing up subjects foreign to business when soliciting applications for electricity.

Mr. Elliott heartily indorsed the point which Mr. Turner had disagreed with in Mr. Kelley's remarks, saying that while it might divert from business temporarily, a personal subject was harmful in gaining confidence.

New Applications of Electricity

The paper by Prof. F. C. Caldwell, of Ohio State University, Columbus, described a number of lesser known uses of electricity, pointing out that the central-station man should welcome those which, even though involving small consumptions in themselves, contribute to the convenience of the customer, in this way adding to the attractiveness and indispensability of central-station service. In the field of electric cooking Professor Caldwell told of the development of improved stoves and ranges, application of thermostatic control, low-wattage fireless cookers, unity-load-factor ranges, etc. For the electric heating pad, the electrically heated garment, electric warming pan and other similar conveniences he predicted an increasing future usefulness. Electric sterilization of the household drinking supply is another new application. By using the hot, boiled water to

warm the cold, raw water, one of these sterilizers treats water at a cost of 1 cent per gallon, with energy at 10 cents per kw-hr. A new French sulphur-dioxide refrigerating machine produces refrigeration at a cost of 16 to 22 cents per 100 lb., with energy purchased at 6 cents per kw-hr. Among laundry uses may be mentioned the heating closet for drying clothes in which an electric fan supplies a blast of air previously heated by electric or other means. Ozonizers are valuable in many ways, a new use suggested being in connection with cold-storage plants where the preservative virtue of the ozone permits a higher temperature to be carried. In closing, the author urged either a reduction in price of both appliances and energy, based on large-quantity production, or a redoubled educational campaign to bring about the greater use of electricity for other than lighting purposes.

Discussion

Mr. F. M. Tait, of Dayton, supported Mr. Martin in his statement that when electric service lines are installed the use of electricity for other purposes than for lighting should be amplified. He described an artificial rainfall apparatus which is used on one experimental farm near Dayton, and also told of the work done in that vicinity in fertilizing a two-acre tract by electricity during the night when there is not much demand on the central station.

Dr. M. W. Franklin, Schenectady, N. Y., told of some interesting practical uses of ozone for purifying water, bleaching cloth, sugar and flour, in cold storage warehouses, in breweries, and in destroying noxious organic odors.

As an extension of the subject treated by Professor Caldwell, Mr. G. D. Smith, of Chicago, read a paper prepared by Mr. H. W. Hillman, Long Island City, N. Y., entitled "A Broad Principle Influencing Electric Truck Sales." This paper commended the central station on the work it has done in educating the public to the uses of electricity and told of what has been accomplished in Baltimore and Hartford toward pushing electric commercial and pleasure vehicles.

On Thursday morning the report presented by the nominating committee was accepted, the officers chosen for the ensuing year being: President, Mr. J. C. Martin, Wilmington (re-elected); vice-president, Mr. C. V. Hard, Worcester, and secretary-treasurer, Mr. D. L. Gaskill, Greenville.

The concluding sessions of the convention will be reported in the issue of next week.

Thirteenth Convention of Missouri Electrical Contractors

In order that electrical contractors in Missouri who were contemplating attending the convention of the National Electrical Contractors' Association in Chattanooga, July 15-18, might attend the State Section of that association and travel in a body to Chattanooga, the convention of the Missouri Electrical Contractors' Association was held at St. Louis July 12. Visiting members en route to Chattanooga were met at the trains on the morning of July 12 and entertained at a breakfast held at the Union Station Hotel, after which there was an executive meeting at the City Club. This was followed by a luncheon at which about fifty were present.

The remainder of the afternoon was occupied by a ball game and by automobile rides around the city. As a final windup for the day dinner was served at the Sunset Country Club.

On Sunday similar entertainments were enjoyed and on Monday the delegates to the national convention left for Chattanooga, Messrs. E. S. Cowie, A. J. Burns, Charles Pierson of Kansas City, Mo., and F. B. Adam of St. Louis going direct. Among those registered as going by way of Cincinnati were Messrs. C. J. Drees, Little Rock, Ark.; F. Bragg, Little Rock, Ark.; George Rush, Hot Springs, Ark.; G. G. Berkholder, Kansas City, Mo., and George Corrao, B. Koeneman, William Dennison, Charles J. Sutter, James Fenton and F. D. Phillips, all of St. Louis.

Sociological and Industrial Aspects of Centralization of Energy Production

In a recent address at the University of Illinois Mr. Samuel Insull, of Chicago, spoke on the influence of engineering on modern civilization. In relation to the modern tendency toward unified operation of electric-service plants he said:

"The development of the business of the generation and distribution of electric energy will probably have within the next quarter of a century great influence on the development of our local communities, not alone the large cities but also the rural communities throughout our states, wherever there is any considerable density of population. Heretofore the business of producing and distributing energy on an economical basis has been confined very largely to our large cities, but the marvelous work of our engineers during the last two decades, the great changes that have taken place in connection with the development of the prime movers, the changes from the reciprocating engine to the steam turbine, the changes in the use of units of from 1000 hp to 5000 hp to units of from 20,000 hp to 40,000 hp, are producing changes in the cost of the energy which will lead to the centralization of production and distribution in the interests of economy. These changes, bringing about low cost to producer and low price to the consumer, must have a very great effect in the development of the industrial interests of such states as Illinois.

"It is to-day not only a possibility but an actuality that the same advantages that we enjoy in large communities can also be enjoyed by the farmer, by the rural community, by the people having large areas to drain; the same privileges of low cost of energy can be obtained for them as are obtained for the users of energy in the large centers of population.

"Suppose any very small community anywhere in the thickly populated territory of the Mississippi Valley is able to obtain energy for manufacturing purposes at low cost. Assuming that in those communities the manufacturer can obtain the necessary labor, it stands to reason that one of the great troubles of modern life will be solved by cheap energy. At the present time large manufacturing interests as a rule cluster around large centers of population. The reason for that is that power is relatively cheap where they have a large population to draw on for their labor.

"But as this State and other surrounding states become studded with manufacturing establishments the necessity which compels the workman to dwell in large centers of population, where living conditions are most unfavorable to him, will cease. He will be able to establish himself under conditions where he can get healthful environment for his family. Instead of living in a small, overheated, ill-ventilated tenement in the big city he will have the opportunity to establish himself practically amid the desirable conditions that those living in the country ordinarily enjoy.

"Surely if this can be accomplished, if the living conditions of our people can be improved, if their children can be brought up under circumstances which will give them the foundation of good health, which will give them the opportunity of association in our country schools with that portion of the population, the farming population, which is the very backbone of the country, it is reasonable to expect greater satisfaction on the part of the workmen with their conditions and better relationship, because of a closer community of interest with employers, and in general a better chance for the workman and his family."

Pennsylvania Utilities Bill

The Legislature of Pennsylvania, very recently adjourned, passed a public utilities bill which bears the title "The Public Service Company Law" and provides for the establishment of a public service commission, for the regulation of public utility companies, to a limited extent for the regulation of municipally owned utilities, for the regulation of railroad crossings, for the abolishment of the State Railroad Commission and for the repeal of any other inconsistent legislation.

Powers of Public Service Companies

Every public service company may charge and collect reasonable tolls, rates, or fares; establish sliding scales after approval by the commission; adjust rates automatically in relation to dividends paid stockholders, upon approval of the commission; to participate as the commission may deem wise in the additional profits resulting from economies or improvements in service; to establish different classes of patrons or consumers upon any reasonable basis, such as nature of use, quantity used, time when demanded, bulk value, facility of handling, etc.; require payment of charges in advance under reasonable conditions; establish reasonable minimum payments, and require deposits to secure future payments; make cash discounts for prompt payment, or impose penalties for failure to pay promptly; to make complaint to the commission in like manner and with equal effect as any consumer or patron; and to pay to any patron or customer a reasonable sum for any service directly or indirectly rendered.

No public service company may be incorporated or created, obtain, exercise or renew its charter rights or privileges except after obtaining in due formal manner from the commission a certificate of public convenience and necessity; this applies as well to foreign public service companies and to consolidations or mergers within the state. It applies with equal force to municipalities desiring to acquire, construct or commence operating a public utility plant of the kind already operated by a company within the municipality, provided that this requirement shall not affect the right of a municipality to continue operating or to extend its plant when no private company is serving the same territory.

It shall be lawful for any company to issue securities only in the manner prescribed by statute, for money, labor done, or property actually received. Application to the commission may be made for a certificate of valuation to the effect that the provisions of law have been met. In the case of securities running for more than one year, every company shall file with the commission a certificate of notification, in the prescribed form, giving the total amount of issue, prior securities outstanding, details of the new issue, par value (in the case of stock), maturities, interest rate, and redemption. Such certificates shall be verified by affidavit of the fiscal head of the company. No act of the commission shall affect the validity of such issue.

Upon approval of the commission evidenced by a certificate of public convenience and necessity, and not otherwise, it shall be lawful for one railway to construct its tracks across another, or for one utility company to construct its facilities across those of another; and upon like approval to relocate or abolish such a crossing.

Capitalization of franchises or rights is forbidden in excess of the amount actually paid therefor to the commonwealth or one of its political subdivisions. It shall likewise be unlawful to capitalize any contract of sale or merger, or to issue by way of substitution any securities exceeding the aggregate value of the properties merged or consolidated plus any additional sum in cash, or any additional property or labor actually contributed, and the same applies to any reorganization effected under the act of 1861 regarding the sale of railroads, canals, etc.

Hereafter it shall be unlawful for any utility to acquire or hold a controlling interest in any other utility company without formal consent of the commission, but this shall not apply to holdings which do not amount to a controlling interest, and does not affect holdings previously acquired. After Jan. 1, 1914, it shall be unlawful for any company to give service if it has not posted its tariffs and schedules as required and previously described.

Constitution of Commission

The commission will consist of a chairman at a salary of $10,500 and six members at $10,000, appointed by the Governor by and with the consent and advice of the Senate. There will be a secretary at a salary of $5,000 annually, a counsel at $7,500, an assistant counsel at $5,000, a marshal at $2,000, and an investigator of accidents at $5,000. The attorney-general will be ex-officio the general counsel of the commission, and the latter may employ such experts, engineers, statisticians, accountants, inspectors, clerks and other employees as it needs. The principal office of the commission will be at Harrisburg.

Powers and Duties of Commission

The powers and duties of the commission are elaborately defined and in general cover the following: To inquire into and regulate service, rates, fares, tolls or charges, condition of plant, safety and convenience of patrons, and adequacy of facilities; hold hearings upon complaint or its own motion; order reasonable, safe, adequate and sufficient service, facilities and regulations, and reasonable maximum fares, rates, tolls and charges; upon notification of intended changes in service, rates or regulations to hold hearings and investigations and issue any order in relation thereto which the facts justify; to order reparation to patrons where an order of the commission has been disobeyed; to regulate the traffic arrangements of street railways; to enforce joint through routes, classifications, schedules, service and rates, and apportion the costs thereof and the revenues therefrom; to regulate railroad crossings and all matters involved therein; to establish and maintain standards of service; to require adequate service and facilities; to supervise the issuance of securities; to prescribe and enforce regulations respecting the keeping of records and accounts, and to examine the same as desired; to subpoena and examine witnesses, compel the production of books, papers and records, make physical examinations and valuations, and any related investigations; to determine the fair value of the property of every public service company, including consideration of original cost, security issues, earning capacity under rates fixed by statute, expenditures for obsolescence, reproduction cost, and going concern value; to make revaluations from time to time; and to determine amounts to be paid for franchise rights and privileges.

The act establishing the Railroad Commission is repealed as of July 1, and that commission was then required to hand over its records, files and cases pending to the new commission. The new act becomes effective on Jan. 1, 1914, although the commission shall be appointed and organized on or before Oct. 1 and in the interim may issue general orders and dispose of pending railroad cases.

Underground-Contact System Proposed for Chicago Street Railways

By Section 4 of the "traction settlement" ordinances adopted in Chicago in 1907 it is provided that after three years from the date of acceptance of the ordinance the city shall have the power to cause the street-railway companies to operate by electrical energy "transmitted through working conductors carried in conduits below the surface of the street and between and underneath the rails, otherwise known as the underground trolley system, and shall there-

after cease to operate the same by overhead trolley." Section 25 provides, however, that the companies shall not be required to make the improvement if to do so would increase the total capital investment to such an extent that the return thereon above the interest charge of 5 per cent authorized by the ordinance would be reduced to an inadequate or unreasonably small amount.

Acting under the ordinance Mayor Harrison sent a communication to the City Council on July 14 recommending that the street-railway companies of the city be required to put their contact wires beneath the surface in the area bounded by North Avenue on the north, Lake Michigan on the east, Thirty-first Street on the south and Ashland Avenue on the west. The recommendation and proposed ordinances accompanying it were referred to the local transportation committee.

It is unlikely that the companies will submit to the change unless compelled to do so. New York and Washington are the only cities in the United States where the sub-surface-contact system of electric-railway operation is used. The underground system is, of course, extremely expensive compared with the overhead trolley and is more difficult to maintain and operate.

Public Use of Energy from Fort Snelling Development

Mr. John Lind, ex-governor of the State of Minnesota, appeared before a recent meeting held at St. Paul to discuss the granting of waterpower rights at lock and dam No. 1 on the Mississippi River between St. Paul and Minneapolis, and pointed out that any step to dispose of the hydroelectric energy to the highest bidder would violate the relationship existing between the state and the federal government. At the session, which was presided over by Col. C. L. Potter, corps of engineers, U. S. A., the rights were offered to the state of Minnesota through the university and the cities of St. Paul and Minneapolis. The federal government is also to obtain energy for use at the Soldiers' Home, Fort Snelling, and in the federal buildings at Minneapolis and St. Paul. Colonel Potter requested that the dean of the College of Engineering, University of Minnesota, and the city engineers of Minneapolis and St. Paul form an engineering board to report before Dec. 1 on the technical and financial features of the use of energy by the existing state corporation, as was authorized by an enabling act two years ago.

Louisville Merger Now Complete

On July 10, the Louisville Gas & Electric Company came into full control of the gas and electric utility situation in Louisville, Ky., by purchasing from the stockholders of the Kentucky Electric Company all of the stock of that corporation. The Louisville utilities merger is now complete, the companies which have been combined being the Louisville Gas Company, Louisville Lighting Company, Kentucky Heating Company, Kentucky Electric Company, Geo. C. Fetter Lighting Company and the Campbell Electric Company, as reported in our issue of last week.

In accordance with agreement with the city, work will be started at once upon the natural gas pipe line from West Virginia, and it is thought possible that natural gas will be distributed in Louisville some time during the winter. Another possibility in connection with the merger is the expansion and unification of the steam-heating systems of the various utilities to serve additional territory.

Stockholders in the new company have authorized the issuance of $7,500,000 five-year 6 per cent bonds, all of which have been sold. The controlling interest in the new company is held by the Standard Gas & Electric Company, one of the Byllesby companies. The property will be under the management and operation of H. M. Byllesby & Company.

Registration of Electrical Contractors in Chicago

By an ordinance just passed by the City Council of Chicago all persons or corporations desiring to install wires or other electrical apparatus in that city must obtain a permit from the city electrician before commencing electrical construction work. Any person or corporation making application for a permit must file an affidavit stating that the work to be done will be under the supervision of a person not less than twenty-one years of age who has a thorough knowledge of electrical construction and who has had not less than four years of practical experience in wiring and electrical construction work. The affidavit must contain the name and signature of the person under whose supervision the work is to be done. It must also bear the indorsements of two responsible citizens. Upon the filing of this affidavit, if found proper, and upon the payment of a fee of $25, the city electrician shall issue a certificate of registration to the applicant. This certificate entitles the contractor to obtain permits to install electrical apparatus for the period of one year. Renewals of the certificate of registration will be at the rate of $10 a year. The ordinance is designed to put a check on the operations of incompetent and inexperienced men posing as electrical contractors.

Regulation of Water-Power Development in Wisconsin

The Legislature of Wisconsin is considering a bill for the regulation of water-power development in that state which is receiving much attention from capitalists interested in the subject. It will be recalled that a very drastic bill on this subject passed the Legislature of Wisconsin about two years ago and was nullified by the courts as unconstitutional. The committee of the state Senate has taken the position that the bill now under consideration safeguards the rights of the public and is liberal enough to encourage the investment of capital for the legitimate development of water-powers. However, the men interested in hydraulic development are opposed to several features of the bill, notably the provision giving to the state the right to take over water-powers at the expiration of the thirty-year period of the franchises to be granted. It is contended that the proposed law allows the state to confiscate the property of water-power companies without just compensation. The water-power men do not object to the principle of conservation of natural resources, but say that the greatest waste is due to the non-use of these resources.

Separate Company to Build Cincinnati Plant

With the exchange of minority stock of the Union Gas & Electric Company for 5 per cent debenture bonds of the Columbia Gas & Electric Company now completed, many operating economies are expected to result from the complete ownership by the Columbia company, although it is likely that the corporate existence of the Union company will still be maintained as a leasing company.

The present plan will facilitate the arrangements for building a new generating station on the river front, to take the place of the company's Plum Street plant. This new station, it is now understood, will be erected by a separate power-house company to be incorporated in Ohio, and as at present contemplated the underlying corporation, the Cincinnati Gas & Electric Company, will donate the site. Nearly $5,000,000 will be expended on this station.

The power house company is to erect the plant through the sale of bonds at 90, half of the issue (the whole not to exceed $10,000,000, at 5 per cent for 40 years) to be taken by each company. The power house company is to lease the plant to the Union company for a term coextensive with the present lease of the Cincinnati properties to the Union.

It is proposed that the Cincinnati company shall provide its half of the power house bonds by an issue of 5 per cent forty-year sinking-fund bonds, secured by mortgage on its properties, one-half of the power house bonds to be deposited thereunder. There is to be a stipulation in the mortgage for the retirement of the $1,500,000 Edison bonds and the Cincinnati company to be protected by a lien on the power house property. The other half of the power house bonds are to be taken by the Union and Columbia companies.

Missouri Commission Complete

Mr. William F. Woerner, a St. Louis attorney, has been appointed the fifth member of the Missouri State Public Service Commission. Previous to his appointment two other lawyers, a civil engineer and a railroad engineer were appointed, thus making three lawyers in all. Mr. Woerner introduced into the St. Louis City Council in 1903 the railway tax ordinance, the validity of which is being so vigorously contested at the present time by the United Railways Company of St. Louis. Mr. C. B. Bee of Oklahoma City, who was formerly rate expert for the Oklahoma Public Utility Commission has been appointed to a similar position for the Missouri commission.

Electric-Rate Discussion in Chicago

At the meeting of the committee on gas, oil and electric light of the Chicago City Council on July 9 the reading of the rate-investigation report of Mr. Ray Palmer, city electrician, was resumed. Parts of the report relating to intangible values, working capital and revenue were taken up. Alderman Merriam questioned the item of $3,224,256 allowed in the report as an addition to capital value for intangible values in connection with the acquisition of competing properties. Mr. C. B. Willard, expert accountant for the city comptroller, who assisted in the preparation of the report, explained that the money was expended in good faith. Mr. A. C. King, an engineer of the department of electricity, who also assisted in preparing the report, said that in cities where there are several competing electric-service companies experience has shown that the condition is unfavorable to the interests of the consumers. In Chicago, block-lighting plants, which are not subject to city control, usually charge higher rates than the Edison company. Mr. W. J. Norton, of the Commonwealth Edison Company, declared that the allowance made for old properties in the Byllesby appraisal (which was in the main followed in the Palmer report in this particular) is a conservative one. He said that this allowance has been referred to as a "nuisance value" in Wisconsin. Alderman Merriam also questioned the allowance of $575,700 for free wiring. He thought that this allowance (based on a practice followed several years ago but which has since been discontinued), should be considered in the nature of a reduction of rates and not charged to capital account.

At the following day's session Mr. Palmer explained the $3,224,256 item as the excess cost of the intangible value of acquired properties. He said it was true that this item showed that the company had paid for something it could not use, but in the modern economic tendency toward monopoly and regulation this procedure seemed to be inevitable. The company should be entitled to the allowance, figuring on original-cost basis; otherwise the valuation would be on a reproduction basis, which would be inconsistent with the method followed in making the whole valuation. Alderman Merriam declared that similar excess cost of acquiring competing plants (aside from an allowance for the physical value of such competing plants) had been thrown out by the city in the gas-rate case; the city ought to be consistent, he thought. Mr. Palmer quoted Mr. Halford Erickson, a member of the Railroad Commission of Wisconsin, in support of his position. The city electrician expressed his belief that the company has acted in good faith in the matter of acquiring competing companies and should be entitled to the allowance for the intangible values involved in the transaction.

The reading of the report was then resumed, and the portions relating to expenses for the year 1911, purchased energy, other expense, and depreciation allowance, were taken up. The rather striking coincidence was brought out that, in independent studies and by different methods of computation, Messrs. King and Willard arrived at almost the same allowance for depreciation as is made in the accounting system of the Commonwealth Edison Company.

Long Acre Electric Light & Power Decision

As recorded in the March 8 issue of the Electrical World, an order was made by the Public Service Commission of New York State, First District, approving the construction of an electric light plant by the Long Acre Electric Light & Power Company. Since 1908, when application for permission to issue $50,000,000 in bonds and $10,000,000 stock was denied by the Commission, the Long Acre company has passed through a series of legal actions, resulting in turn both favorably and unfavorably. In September, 1912, another complication was introduced by the acquisition of a major portion of the company's outstanding bonds by New York Edison Company interests, the latter concern having opposed from the start the formation of a competing electric light and power company in New York City.

On a writ of certiorari, the order of the Public Service Commission, dated March 5, was reviewed by the Appellate Division of the Supreme Court, First Department, and a decision has just been rendered sustaining this order. The only opinion given was that of Judge Ingraham, dissenting. An appeal is to be taken by the Edison company and the case will probably come up before the Court of Appeals some time this fall. The Long Acre Company is controlled at present by A. B. Leach & Company and allied interests.

Petition Against Colorado Commission Bill

The Colorado public utilities commission bill, passed by the last legislature and signed by Governor Ammons, has been "referred" under the state referendum law, by the presentation of a petition to the Secretary of State, signed by over 18,000 persons and asking for a referendum on the entire bill. This petition was circulated by Mr. D. A. Camfield, an irrigation and power project promoter. The usual method of circulating the petition by means of canvassers paid ten cents per signature was followed.

N. D. Smith, who is promoting an automatic telephone company for Denver, has also filed a petition of over 18,000 names, similarly obtained, for referendum on sections 35, 36 and 37 of the bill. The latter two sections give control over stock issues, mergers and financial management. Section 35 grants indeterminate franchises and sustains regulated monopolies.

Governor Ammons is very much opposed to receiving the petitions, feeling that a defect in the initiative and referendum law is being taken advantage of through a regu-

lar organization which obtains signatures at a certain price. He has threatened to call a special session of the legislature to pass a utilities law with no saving clause by which it may be referred. Counsel has, however, advised that the standing of such a law might be questioned should the statute now referred be again passed by the referendum vote.

The law is largely modeled after the California law and is somewhat defective in not providing definitely for regulation of municipally owned utilities nor specifically exempting them. The question of home rule under existing charters is also not determined.

After July 15 a law passed by the last legislature will become effective, providing for inquiry into legality of petitions filed under the referendum law and this law may be taken advantage of by the governor. The findings of the Secretary of State are final, subject to review by the courts.

If an extra session is called the Governor declares that a bill will be passed making it a penal offense to circulate petitions of this kind for pay. Business men are backed by the Secretary of State in opposing an extra session on account of the great unrest and business depression attendant upon consideration of radical changes in legislation by the state.

Intangible Values in Rate Making

The Supreme Court of New Jersey on July 7, 1913, sustained the validity of the order of the Board of Public Utility Commissioners of New Jersey in requiring the Public Service Gas Company, a subsidiary of the Public Service Corporation of New Jersey, Newark, to establish a 90-cent gas rate within the district which embraces Passaic. The decision of the board was published in the *Electrical World* of Jan. 4, page 36. The principal question at issue was the valuation of the intangible property of the company, and in this matter the court upheld the ruling of the commission. To determine the correctness of the decision on which the order of the Board of Public Utility Commissioners was based, the company, with the knowledge and the approval of the commission, decided to obey the order and sue out a writ of certiorari in the Supreme Court of the State. The company has now announced that it will appeal the case to the Court of Errors and Appeals.

Probable Franchise Compromise at Lexington, Ky.

It now appears probable that a compromise will be reached in the franchise controversy between the city of Lexington, Ky., and the Lexington Utilities Company, the local subsidiary of the Kentucky Traction & Terminal Company. The city attorney has ruled that the referendum by which the franchise awarded the company was canceled, was valid. The city officials are desirous of reaching an agreement with the company, however, and a new franchise has been drawn up and probably will be adopted.

Public Service Commission News

Maine Commission

Petitions bearing the signatures of more than 10,000 voters have been filed at the office of the Secretary of State at Augusta asking for a referendum on the recent Maine public utilities act. This action will prevent the act's becoming operative ninety days after the adjournment of the recent Legislature. A special election may be called by Governor Haines to determine the acceptance of the act, or, if desirable, he may designate the general election in September, 1914, as the time when the voters shall approve or disapprove the law. As recently announced in these columns, the act provides for the creation of a commission of three members to have general supervision of all public utilities within the State.

Ohio Commission

The Sandusky City Council has asked the Public Service Commission to issue an order to allow the city to examine the books of the Sandusky Gas & Electric Company for the past ten years, in order that the city may be better prepared to make an offer for the property, when it decides upon municipal ownership. The company refused to grant the city's request to examine its accounts.

New York Commissions

A reduction in the price of gas from $1 to 95 cents per 1000 cu. ft. has been ordered by the Public Service Commission for the First District in the Thirty-first Ward of Brooklyn, supplied by the Brooklyn Borough Gas Company. The new rate will take effect Oct. 1, and continue in effect until Dec. 31, 1914. The original complaint against the Brooklyn Borough Gas Company was filed in October, 1910, but after hearings it was dismissed by the Commission, with the statement that conditions at that time did not warrant a reduction. On the second complaint the Commission made a careful examination and appraisal of the company's plant and property. The commissioner found that the company's sales of gas have increased from 213,817,000 cu. ft. in 1910 to 273,253,000 cu. ft. in 1912; and that its operating income has increased from $76,566.26 in 1910 to $98,479.76 in 1912. While the sales have increased the operating expenses have decreased, the manufacturing cost, which was 31.29 cents per 1000 cu. ft. in 1909, having fallen to 21.26 cents in 1912. The commissioner finds that a return of 7½ per cent would justify a rate of about 92 cents for 1913 and about 89 cents for 1914; and a return of 8 per cent would justify a rate of about 94 cents for 1913 and 91 cents for 1914. Allowing for possible increases in the cost of production, etc., the Commission found that 95 cents per 1000 cu. ft. would be a reasonable rate for the remainder of 1913 and all of the year 1914. If conditions continue to improve another reduction in the price will be possible in 1915.

Current News Notes

ANNUAL MEETING OF THE JOVIAN ORDER.—The Jovian Order will hold its annual meeting at the Hotel Astor, New York, Oct. 14, 15 and 16. Mr. E. C. Bennett, 1412 Syndicate Building, St. Louis, Mo., is secretary of the order.

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CLEVELAND'S NEW CHARTER.—By a vote of 24,037 to 12,077 the electors of Cleveland adopted a new charter on July 1. It is drawn in accordance with the "home-rule" amendment to the state constitution. The city is empowered to institute municipal ownership by condemning the property of public-service corporations. Cleveland newspapers speak of the charter as an embodiment of the ideas of the late Tom L. Johnson.

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THE LINEMAN'S BED.—From Paterson, N. J., comes the latest story of the antics of the central-station lineman. This particular gentleman, it would appear, stopped at too many places on the way home, as linemen (and others) will, and finally, bethought himself of a place of refuge—a pole line. His slumbers were sound while they lasted, at least judging by the snores. Successfully resisting all efforts to awaken him by usual methods, he compelled the fire department finally to escort him back to the channels of surface traffic, and incidentally the "wagon." And the story goes that the magistrate discharged him—probably because he was "clearing trouble."

Chicago Vehicle Men Going on a Picnic.—The Chicago Garage Owners' Association and the Chicago Section of the Electric Vehicle Association of America will enjoy their first annual picnic and field day at Cedar Lake, Ind., on July 25. A special train on the Monon Railroad will leave the Polk Street station at 10:30 a. m. Tickets may be obtained from Mr. E. D. Kelly, Metropole Hotel, Chicago.

* * *

Mining Congress and Exposition.—A mining exposition will be held at Philadelphia during the week of Oct. 20 in connection with the forthcoming American Mining Congress scheduled for the same dates. Manufacturers of mining machinery and rescue, first-aid and safety apparatus are invited to display their products at the exposition, which will be the first of its kind in the country. Mr. J. T. Callbreath, Munsey Building, Washington, D. C., is secretary of the American Mining Congress.

* * *

Colorado Electrical Statistics.—Colorado has $80,000,000 invested in electric lighting and power properties, according to a statement just issued by the Colorado Electric Club. The state has 6000 miles of electric-light and power wires, 222,000 miles of telephone wire, 4790 miles of telegraph wire, 400 miles of street railways and 800 street cars. About 100,000 acres of land have already been reclaimed by electric pumping. Colorado has more irrigated land than any other state, although hardly one-fifth of it is in farms.

* * *

Civil Service Examination for Electrical Machinist.—Applications will be received until Aug. 4 for the Civil Service examination for electrical machinist, for a vacancy in the Signal Service at Large, Fort Wood, N. Y., at $1,000 per annum. Applicants should be practical machinists with three years or more experience in the repair of telephones, telegraph instruments, radio apparatus and other small electrical instruments. Persons desiring to take the examination should write for Form 1312, United States Civil Service Commission, Washington, D. C.

* * *

Telephone Complaint Bureau in Chicago.—Steps are being taken by the Chicago City Council to establish the telephone complaint bureau provided by the Chicago telephone-rate ordinance of May 26. It is proposed to employ a telephone commissioner at a salary of $3,000 a year and an investigator at $1,500 a year with a stenographer at $840 a year. At a recent meeting of the Council committee on gas, oil and electric light City Electrician Palmer suggested that the scope of the bureau might be broadened to include complaints relating to gas, electric and water service.

* * *

To Lease Additional Water-Power Rights at "Soo."—The Michigan-Lake Superior Power Company has filed with the International Joint Commission at Washington, a proposed lease for water and the constructing of compensating works across St. Mary's River at Saulte Ste. Marie, Mich. Terms of the lease provide for a continuous flow of 25,000 cu. ft. of water a second, with a possible increase of 5000. A yearly toll of $2.50 a cubic foot a second, and $1 a cubic foot a second for all water in excess of 25,000 cu. ft. will be paid the government by the company.

* * *

Ideas of Spanish Singletaxers.—The first Spanish Singletax Congress was held at Ronda, Spain, on May 26-28. The following platform of the Congress in relation to utilities may be of some interest: "Municipal or state ownership of public utilities. Each state or locality to select its own time for making change from private ownership. In accordance with this principle, a law should at once be passed prohibiting governments from extensions or renewals of franchises. Until the state assumes ownership of railroads, they should be taxed on the values of the land and monopolies they enjoy. This method should be employed with telephone, water, electricity and gas companies, in fact, all those who exploit public service, and with which free competition is impossible."

* * *

British Electrical Statistics.—The aggregate capital issued by the electric companies and municipal plants of the United Kingdom during the last year was $2,120,000,000, according to the 1913-1914 volume of Garcke's "Manual of Electrical Undertakings." For 1912 the figure was $2,050,000,000 and for 1911 $1,980,000,000. The amount of capital belonging to the companies is $1,425,000,000, on which sum dividends averaging 4.6 per cent were paid last year, as compared with 4.28 per cent on $1,340,000,000 in 1912. Companies and municipalities sold 1,317,734,150 kw-hr. during 1913 as compared with 1,235,512,163 in the previous year; the kilowatt capacity of plant installed was 1,119,617, against 1,070,851, and the lamps connected equaled 67,020,086 8-cp equivalents, compared with 64,222,086. Although the kw-hr. sales by the municipalities have risen during the last two years from 811.6 millions to 896.8 millions, the business of the companies fell from 423.8 millions to 420.8 millions. The total capacity of plant installed rose from 696,673 kw to 736,236 kw in the case of municipalities, and from 374,178 kw to 383,381 kw in the case of the companies. Again, in lamps connected municipalities showed an increase from 34.5 millions to 37.5 millions, and the companies a decline from 29.7 millions to 29.4 millions.

* * *

SOCIETY MEETINGS

Maine Electric Association Outing.—The annual outing of the Maine Electric Association will be held at Portland on July 24 and 25. An attractive program is being arranged. Mr. W. S. Wyman, Augusta, is secretary.

* * *

Milwaukee N. E. L. A. Section Banquet.—At the banquet of the Milwaukee Section, National Electric Light Association, held at the Hotel Pfister, Milwaukee, July 8, Mr. John Andersen presided as toastmaster, and addresses were given by Messrs. J. D. Mortimer, S. B. Way, R. B. Stearns, George C. Post and others.

* * *

American Mine Safety Association.—The annual meeting of the American Mine Safety Association, composed of leading coal and metal-mine operators, mining engineers mine-safety engineers, and mine surgeons, will be held in Pittsburgh, Pa., September 22 to 24. The program will include a mine-rescue and first-aid contest at Arsenal Park, an explosion in the experimental mine of the Bureau of Mines at Bruceton, Pa., and a visit to the Bureau's experiment station.

* * *

Chicago Convention of Electric Vehicle Association.—The Chicago convention of the Electric Vehicle Association of America will be held in the Hotel La Salle on Oct. 27 and 28. Sessions will be held on the nineteenth floor and exhibits will be displayed on the eighteenth floor. Mr. H. E. Niesz, chairman of the Chicago section, has appointed chairmen of the local committees as follows: Reception and entertainment, Mr. Louis E. Wagner; finance, Mr. George H. Jones; papers, Mr. D. C. Arlington.

* * *

Jovian Lunch Club Formed in Galveston.—There are forty members of the Jovian Order in Galveston, Tex., and at a meeting held on June 26 twenty-seven of them were present and formed a lunch club. This club will meet on the third Monday of each month. Officers were elected as follows: President, Mr. C. W. Matthews, Galveston Electric Company; first vice-president, Mr. W. D. Masterson, city electrician; second vice-president, Mr. K. E. Mason, Brush Electric Company; treasurer, Mr. A. D. McLellan, McLellan Electric Company; secretary, Mr. W. J. Weber, Tschumny Electric Company; press agent, Mr. A. K. Young, Brush Electric Company.

The World's Highest Office Building

Elevator equipment, safety features, generating plant and wiring of the Woolworth Building, New York City. By Charles E. Knox

IN view of its unequaled height, the Woolworth Building, in New York City, has much of interest for the general public, and on account of the serious engineering problems involved it possesses features of particular interest to the engineer. The description below will give some of the details of the elevator installation and the electrical equipment, which were designed by the writer.

It is needless to say that without the modern high-rise elevator the Woolworth Building could not have been erected. The tall building depends very largely on the proper solution of the various problems which arise in the consideration of the elevator installation. It is essential that the elevator service be adequate, that the upper floors be served approximately as well as the lower floors, that every reasonable safety appliance be provided to safeguard the passengers, that proper means of signaling and controlling the cars be provided, and that the acceleration and retardation be as rapid as smooth and efficient operation will permit. While adequate service is essential, on the other hand, if more elevators are provided than necessary to afford good service, the rentable area of the building, and consequently the revenue, are greatly reduced.

It is obvious that the upper stories of the building must be served by through elevators, running from the bottom to the top without change of cars, and consequently some of the elevators in this building have an extremely high rise. The accompanying schedule gives the number and rise of the various elevators. It shows a total of twenty-eight elevators besides one sidewalk lift.

NUMBER AND RISE OF ELEVATORS

Main Group, No.	Runs		Rise, Feet
	From Floor	To Floor	
11, 12, 13, 14	First	Twelfth	145
4, 5, 6, 7, 9, 10, 15, 16, 18, 19, 20, 21	Basement	Twenty-seventh	358
8, 17	Sub-basement	Twenty-seventh	372
3, 22	Basement	Forty-first	530
1, 2	First	Forty-sixth	606
23, 24	First	Fifty-first	689
Service elevators:			
25, 26	Basement	Twenty-eighth	375
Shuttle elevator:			
27	Fifty-first	Fifty-fourth	47
Bank elevator:			
28	Basement	Third	56
Sidewalk lift:			
29	Sub-basement	First	39

From the table it is apparent that there is a wide variation in the travel of the elevators. On account of this difference in the rise, the writer became convinced that special means would be required to maintain a reasonably uniform schedule for the various groups of elevators and designed a dispatcher's system for starting and controlling the elevators

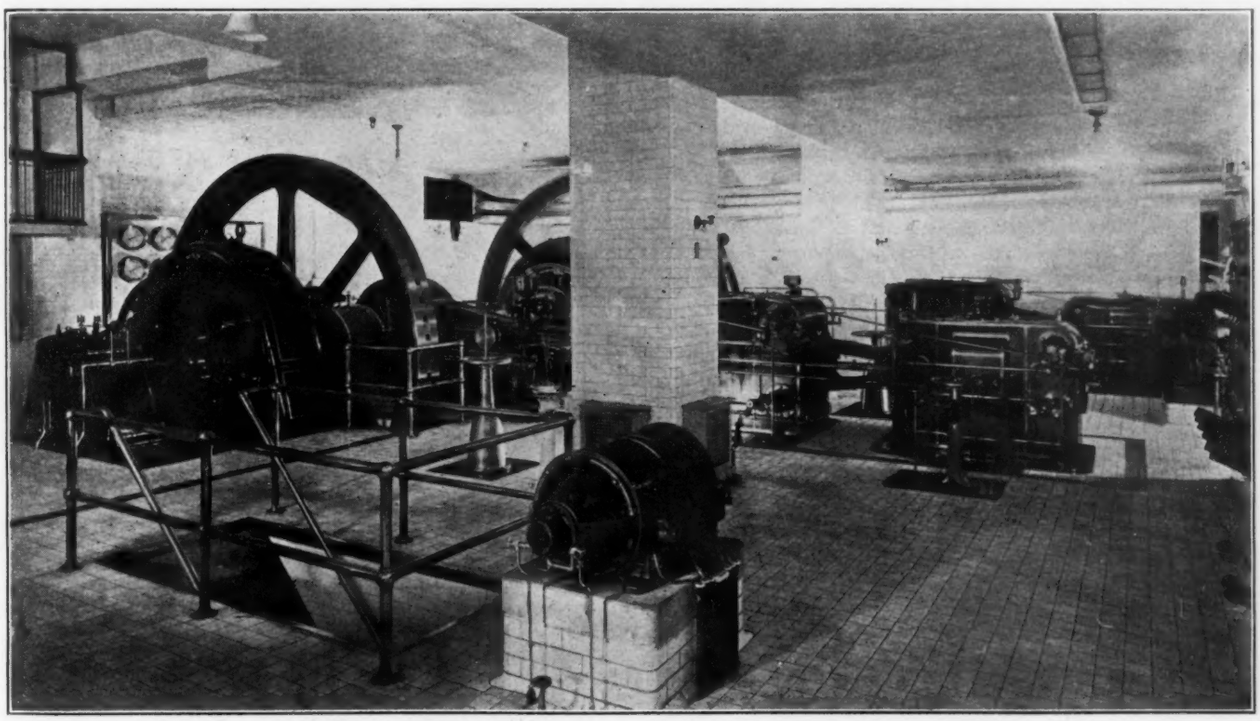


FIG. 1—ENGINE ROOM, SHOWING TWO OF THE FOUR GENERATING UNITS

similar to that used in railway work, which system will be described briefly a little later.

The elevators are designed to run at a speed of 700 ft. per minute, this being the first case where an elevator equipment has been designed for a speed of over 600 ft., the city building rules having been modified recently to permit this higher speed. Of course, the average speed of the

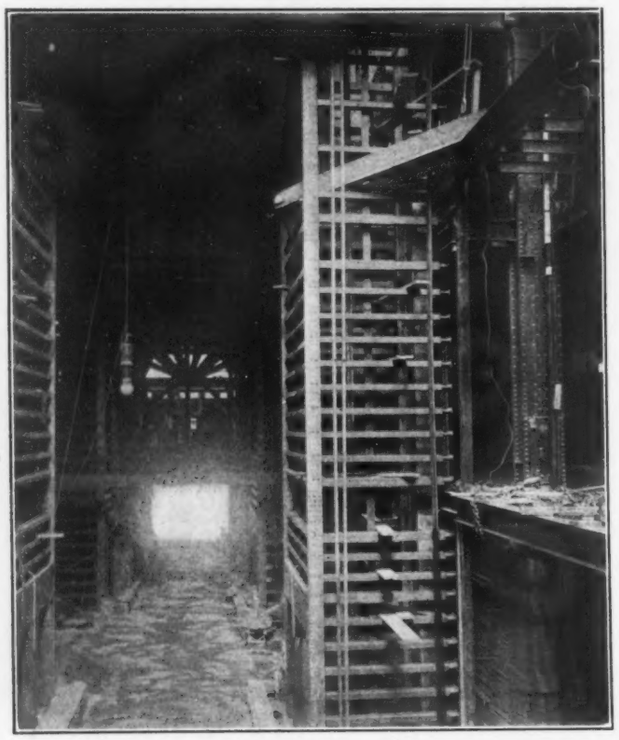


FIG. 2—FRAMING OF ELEVATOR AIR CUSHION

elevator depends upon the distance traveled and the number of stops. It takes approximately 20 ft. for the elevator to accelerate to full speed, and it is obvious that it must be gradually retarded to make good stops at the various landings.

The type of elevator which the writer specified for the Woolworth Building is that known as the gearless one-to-one electric traction type of elevator. The general scheme of this type of elevator is shown in Figs. 5 and 8. The elevator winding machine is located on beams placed at the top of the elevator hatchway. It will be noticed that one end of each hoisting rope is attached to the counterweight and the other end attached to the car. The driving torque is obtained from a motor the armature of which is mounted on a shaft which also carries the driving sheave, the torque being transmitted directly from the armature to the driving sheave. The ropes pass over the driving sheave, thence around the idler sheave placed underneath the driving sheave, back again over the driving sheave, and thence to the counterweight. The object of the idler sheave is to obtain an additional half wrap or turn of the hoisting ropes around the driving sheave, so as to obtain additional tractive force, as one half wrap around the driving sheave would not afford sufficient hoisting torque. The coefficient of traction obtained by this method of drive is approximately two. In other words, under ordinary conditions, a load of approximately twice the weight of the counterweight can be placed at the car end before the ropes begin to slip through the driving sheave.

On the same shaft with the armature and the driving sheave is mounted a large brake pulley, inclosed with a pair of powerful spring-actuated, electrically released brakeshoes. The brakeshoes always grip the brake pulley unless current is applied to the armature, in which case the brake magnets are magnetized and the brakeshoes pulled away, thereby allowing the motor to drive the traction sheave. In case of failure of the electric current from any cause whatever, the brake therefore operates to stop the car. The direct application of the torque from the motor to the driving sheave and the absence of gearing results in an elevator machine of the highest efficiency as well as the greatest simplicity.

While the motor runs at a very low speed (the maximum speed being approximately 68 r. p. m.), it is especially designed for the purpose and its efficiency is very high. The elevators are of the Otis manufacture.

Safety Features

Probably the greatest feature of this type of elevator is the inherent safety which the elevators possess, owing to the peculiar form of drive used. As already stated, the driving force consists of the tractive effort of the ropes on the driving sheave. This tractive effort is obtained by means of the counterweight at one end of the ropes and the weight of the car at the other end. In case the counterweight is at the bottom of the shaft resting on the buffer and the car is at the top, it is apparent that the weight of the counterbalance is removed from the driving ropes and the car cannot be driven any further. In such a case, even if the motor continued revolving, the driving sheave would slip through the driving ropes and the car could not be driven into the overhead work.

Over-travel of the car and counterweight is one of the frequent causes of elevator accidents, and consequently this

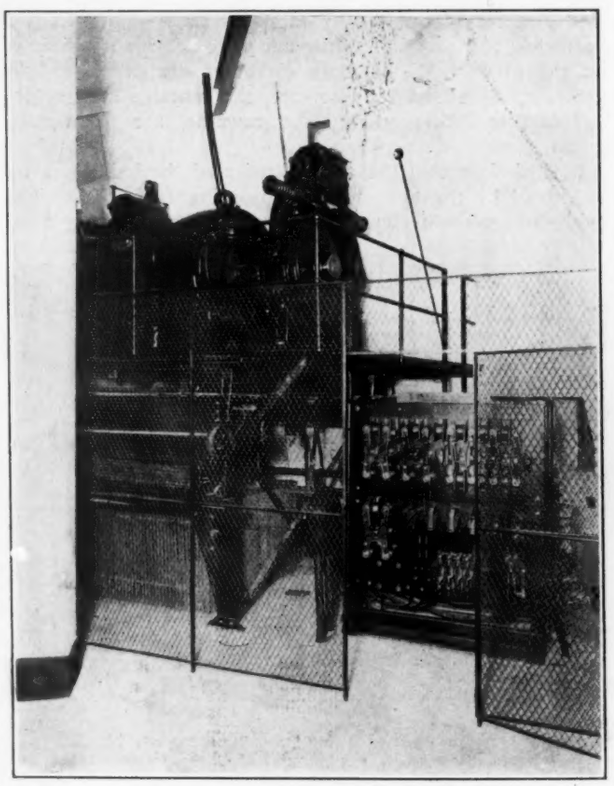


FIG. 3—ELEVATOR MACHINERY ON FIFTY-SECOND FLOOR

safety feature, which is an inherent part of this method of drive, has a very great advantage from the standpoint of safety. In other words, neither the car nor the counterweight can go more than a short distance beyond the limits of travel, because the tractive force decreases or disappears entirely. Of course, the car would have a certain amount of momentum in the event of its tending to travel beyond

the top landing, and to overcome this momentum and stop the car a safety device known as the "retarding and latching safety" is provided for both the car and the counterweight at the top of the hatchway. This device consists of a number of steel wires strongly secured in position at each side of the upper end of the hatchway. These wires pass between pairs of steel plates, and between these plates steel pins are placed, staggered or so located that the wires between the plates pass around and between the pins in such a manner that the plates cannot be moved without deforming or kinking the wire. To move the plates, therefore, a considerable constant force is required, as the wires are stretched somewhat tightly and therefore tend to prevent the movement of the plate. At the top of the car there is provided a projecting bar, or dog, which presses against these plates in case the car or counterweight goes above the top landing. If, for any reason, the other safety devices should fail and the motor continue to run, the car would be quickly brought to rest after it had passed the top landing by the retarding effect of these plates. Latches are also attached to the car, which would rest on the top of these plates in case of over-travel and thereby prevent the car from dropping back. If, therefore, the car should pass the top landing, not only would the force tending to drive it be removed, as already explained, but the further movement of the car would be retarded by this security retarding device.

The usual wedge type of safety has been provided under both the car and the counterweight to stop either the car or the counterweight in case the ropes should break. This safety device is shown in Fig. 8. In consists of a fly-ball

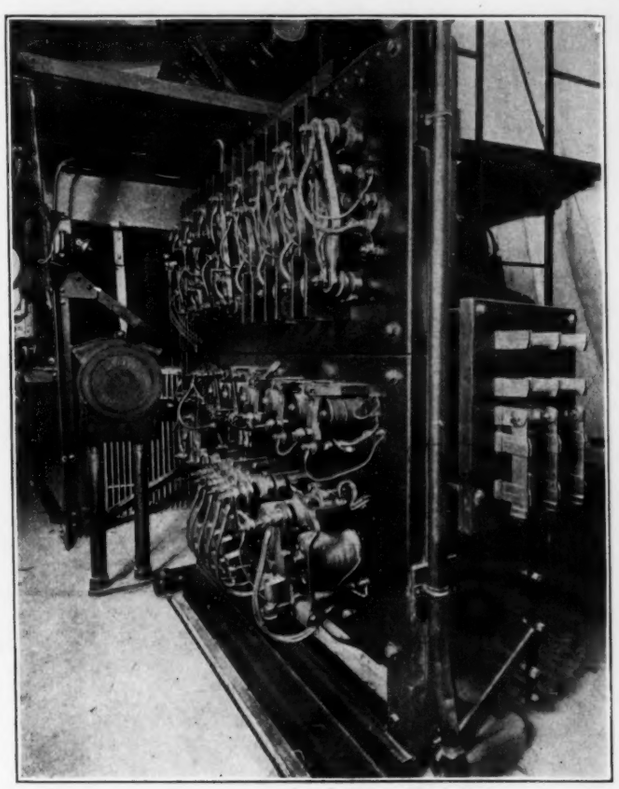


FIG. 4—ELEVATOR-MOTOR CONTROL PANEL

governor placed overhead, driven by a sheave, around which the governor rope passes. This governor rope is attached to a second rope passing around a drum underneath the car. As the elevator car travels the governor rope travels with it, driving the sheave and rotating the balls on the governor at the top of the hatchway. In case the car speed exceeds 800 ft. per minute, the balls are raised by centrifugal force to such a point that two jaws are thrown in action and grip the governor rope. The governor rope is now stopped, and as the car proceeds to travel the drum on the safety plank underneath the car starts to rotate, being driven by the rope passing on its outer grooved surface. The inside of the hub on this drum is threaded, and this thread engages with two shafts, one of which is threaded with a right-hand

FIG. 5—INTERIOR OF ELEVATOR, SHOWING CONTROL LEVERS AND TELEPHONE EQUIPMENT

and the other with a left-hand screw. The continued rotation of the drum drives these shafts in an outward direction. The outer end of each of these shafts is equipped with a wedge which tends to press two very heavy jaws against the guide rails.

These wedges are so shaped that at the beginning of the movement of the drum the clearance between the jaws and the guide rails is rapidly taken up, but gradually the movement becomes less. By this means the car is gradually but surely brought to rest. Of course, the action of the governor and the rotation of the drum and the application of the jaws to the rails are entirely automatic, and the action takes place when the car exceeds a speed of 800 ft. per minute. Before accepting the elevators which were installed in the Metropolitan Life tower the writer made approximately eighty tests of this particular safety device. This device is very seldom called into operation because a number of electric governing and controlling devices which act automatically tend to prevent the car from overspeeding and thereby avoid the necessity of the governor going into operation.

At the bottom of Fig. 8 is shown an oil buffer, another one of the safety devices used on the Woolworth elevators. This buffer is installed so that in case the car should go beyond the limits of travel it would strike the buffer and bring the car to rest without injury to the passengers. This device consists of a large cylinder containing a second inner cylinder. In this latter cylinder is placed a small piston connecting with a piston rod, at the upper end of which is attached a rubber buffer. The cylinder is prac-

tically filled with oil and a spring holds the piston and piston rod at the upper end of the cylinder. The inside cylinder is perforated and has large holes at the top and smaller holes at the bottom. As the striking plate under the car hits the buffer the oil is driven from the inner cylinder into the outer cylinder, and as the piston travels further down, the holes becoming smaller, the continued retarding force brings the car quickly but gradually to rest. The buffers in the high-rise cars in this building have a stroke of 5.0 ft. The writer made tests on the elevators, running the car into the buffer at a speed of nearly 1000 feet per minute, and found the stop perfectly safe and, in fact, not unpleasant.

At the bottom and top of the hatchway provision is made for a series of limit switches which first tend to reduce the amount of current and thereby slow down the car, and finally to shut off the current entirely and bring the car to rest. These switches operate slow-down switches on the con-

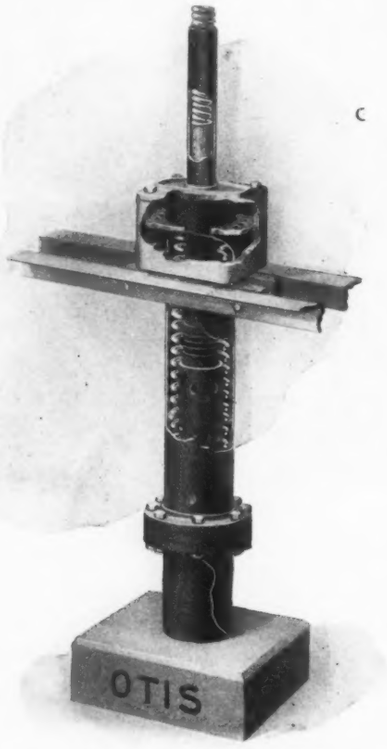


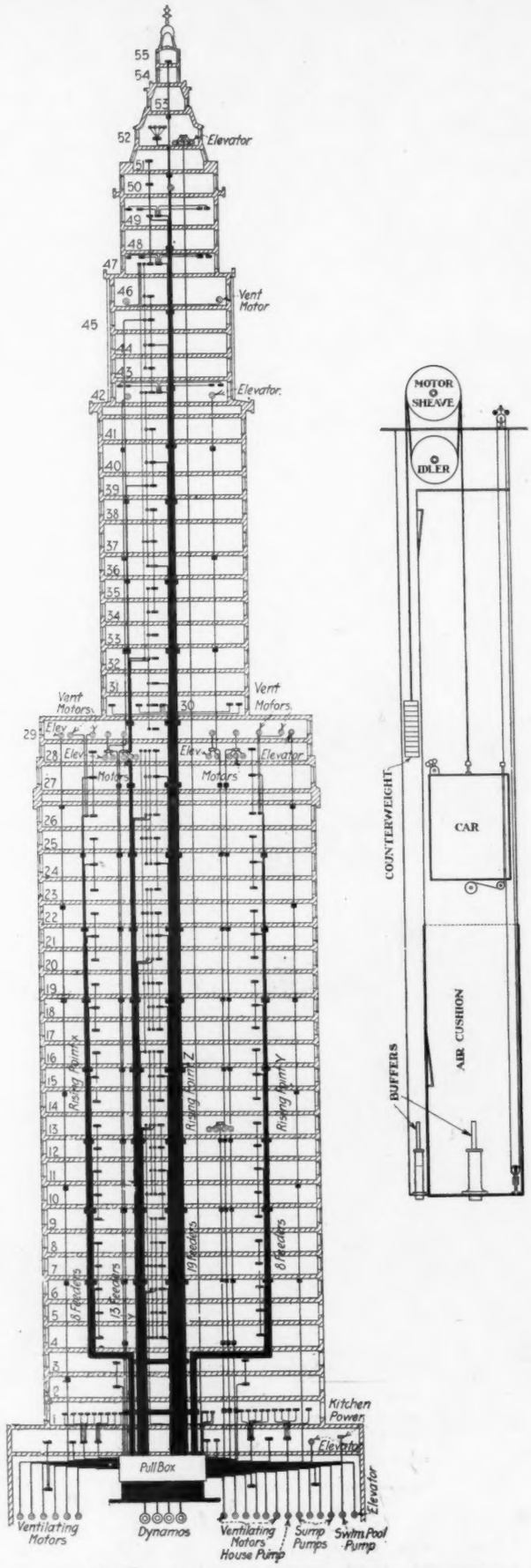
FIG. 6—DETAILS AND PARTIAL SECTION OF OIL BUFFER USED AT BOTTOM OF ELEVATOR SHAFT

troller board and finally cut in the reversing switch, the brake and the potential switch. In the event, therefore, that the operator failed to stop the car, the limit switches would automatically accomplish this purpose.

A small knife switch, known as the safety switch, is installed in each car to open the potential switch and put in operation both the electrical and the mechanical braking devices. On the governor at the top of the hatchway are mounted two switches, the first of which strengthens the field of the motor and reduces the speed in case the car tends to over-speed, and the second of which opens the circuit and applies the electrical and mechanical brakes.

In case the current should fail, or in case the voltage across the line should increase by more than 20 per cent above the normal, the main circuit would be opened and all the emergency stopping devices would be put in operation to prevent the fall of the car.

The car is equipped with an emergency lever which the operator can use to apply the jaws under the car against the guide rails, independently of the automatic governor



FIGS. 7 AND 8—DIAGRAM OF FEEDER RISERS AND DETAILS OF ELEVATOR SAFETY DEVICES

overhead. The operator can, by working this lever back and forth four or five times, apply the undercar safety device and bring the car quickly to rest.

In order to guard against the most frequent cause of elevator accidents—namely, those known as hatchway accidents—the writer specified an equipment of door contact devices so arranged that the operating circuit would not be closed when any of the hatchway doors were open. A very large percentage of accidents are caused through carelessness of the operator, and sometimes through carelessness on the part of the passenger in getting on or off the car. These accidents have become so common that bills are now pending in the Legislature in New York to compel owners to provide a device which will prevent the car from moving until the door is closed.

In addition to the above safety devices, Mr. Woolworth insisted on the installation of air cushions in all of the elevators. These air cushions consist of a wall surrounding the lower portion of each hatchway, extending upward for approximately 20 per cent of the rise of the elevator. These walls are very substantially and heavily built of steel and concrete, and the hatchway doors within the zone of the air cushion are built to withstand the maximum air pressure that would be obtained in case of the car falling from the top. Fig. 2 shows the steel work for one of the air cushions in the course of construction. The clearance between the car and the air cushion has been made as small as practicable so as to prevent too great an escape of air between the sides of the car and the hatchway. If one of the high-rise elevators should fall from the top of the tower, it would attain

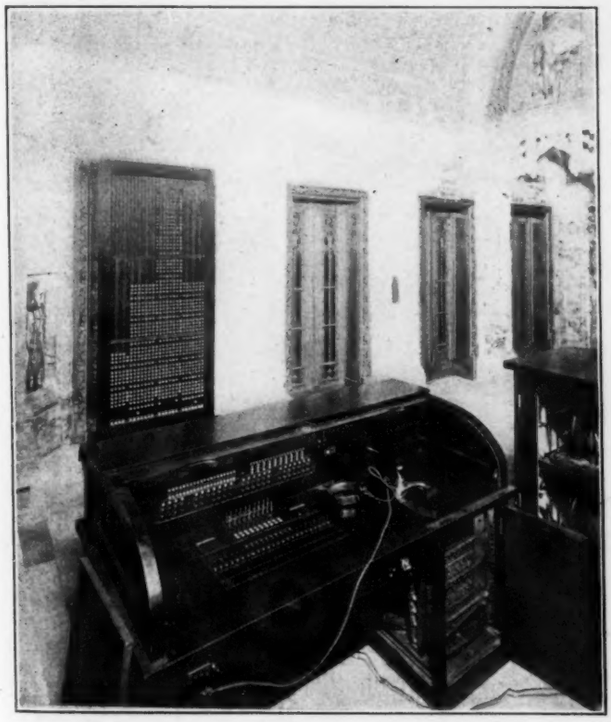


FIG. 9—DISPATCHER'S STATION AND TELEPHONE SWITCHBOARD FACING A FLASHING DIAGRAM OF CAR TRAVEL

a speed of approximately 140 miles an hour at the time it reached the top of the air cushion.

DISPATCHER'S SYSTEM

As already stated, the differences in the heights of rise of the various cars and the grouping of the elevators necessitated special means for starting and controlling the elevators. To accomplish these results the writer designed a special dispatching system which will be used in this building for the first time. The usual method of controlling the elevators is to place at the ground floor a starter who signals the operator and starts each car on its trip. Ordinarily this starter has no further control over the car until it reaches the ground floor again. In some cases in the past the writer made telephone connection to the various cars, sometimes from the starter's position at the ground floor, and sometimes from the engine room, and also used lamp

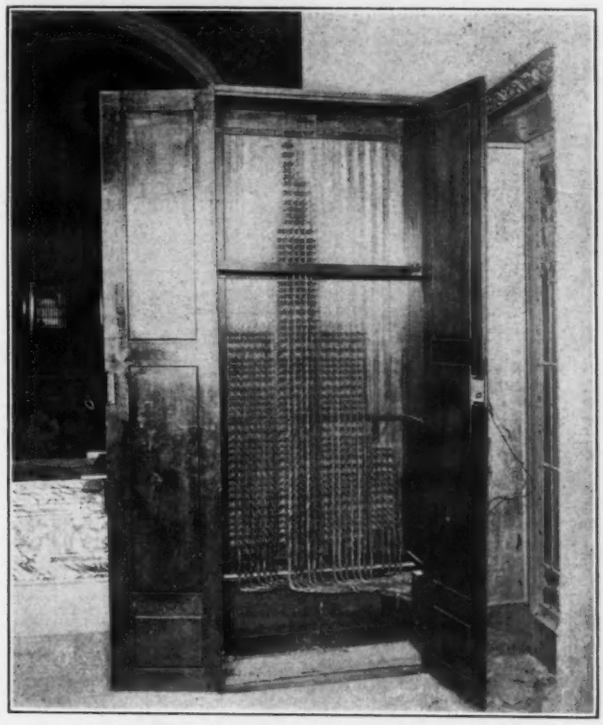


FIG. 10—REAR OF CAR-TRAVEL INDICATOR, SHOWING WIRING TO MINIATURE LAMPS

annunciators showing the position of the cars. Neither of these systems went far enough, and in the Woolworth Building the starting and signaling of the cars will be entirely in the hands of a dispatcher instead of a starter.

The dispatcher's system is located on the second floor overlooking the main group of elevators. Near the dispatcher's desk is placed a lamp indicator, each lamp corresponding to one floor for each of the elevators within its limits of travel. As an elevator passes a floor a lamp on the indicator is momentarily lighted, corresponding to that particular elevator and the floor passed. By glancing at this indicator the dispatcher knows immediately the location of each elevator. He also knows when an elevator stops at any given floor and for what length of time. Furthermore, the indicator shows him whether the elevators are keeping in proper step, that is, whether they are the proper distance apart and maintaining their predetermined schedule. In case an elevator gets behind the schedule, he can send a signal to the operator to skip a certain number of floors and thereby "catch up" to his schedule.

On the dispatcher's desk are also mounted a number of double-push switches which the dispatcher uses to cut out or transfer the signal on any car, so that when an operator falls behind his schedule he would not receive a signal to stop, and it would be transferred to the next car. For the purposes of signaling, the dispatcher has located on his desk a push-button connecting with a buzzer in each car, and also a telephone switchboard connecting with megaphones in the car, by means of which he may communicate orders to the operators, in addition to the code of signals used by means of the push-button and buzzer. The operator can

hear the dispatcher's orders by means of the megaphone without holding a receiver to his ear. In case of necessity the operator in the car may also communicate (by means of a separate telephone) with the dispatcher, but ordinarily it is intended that he should receive orders only and not use the telephone.

Ordinarily when a car drops behind its schedule it retards all of the other cars following, because they lag behind in order to have the first car reach the ground floor ahead of them. In other words, the system usually employed tends to retard the entire service. With the system used in the Woolworth Building, if a car falls behind it is forced to catch up with the schedule by the dispatcher directing it to proceed to the ground floor, thereby distributing the

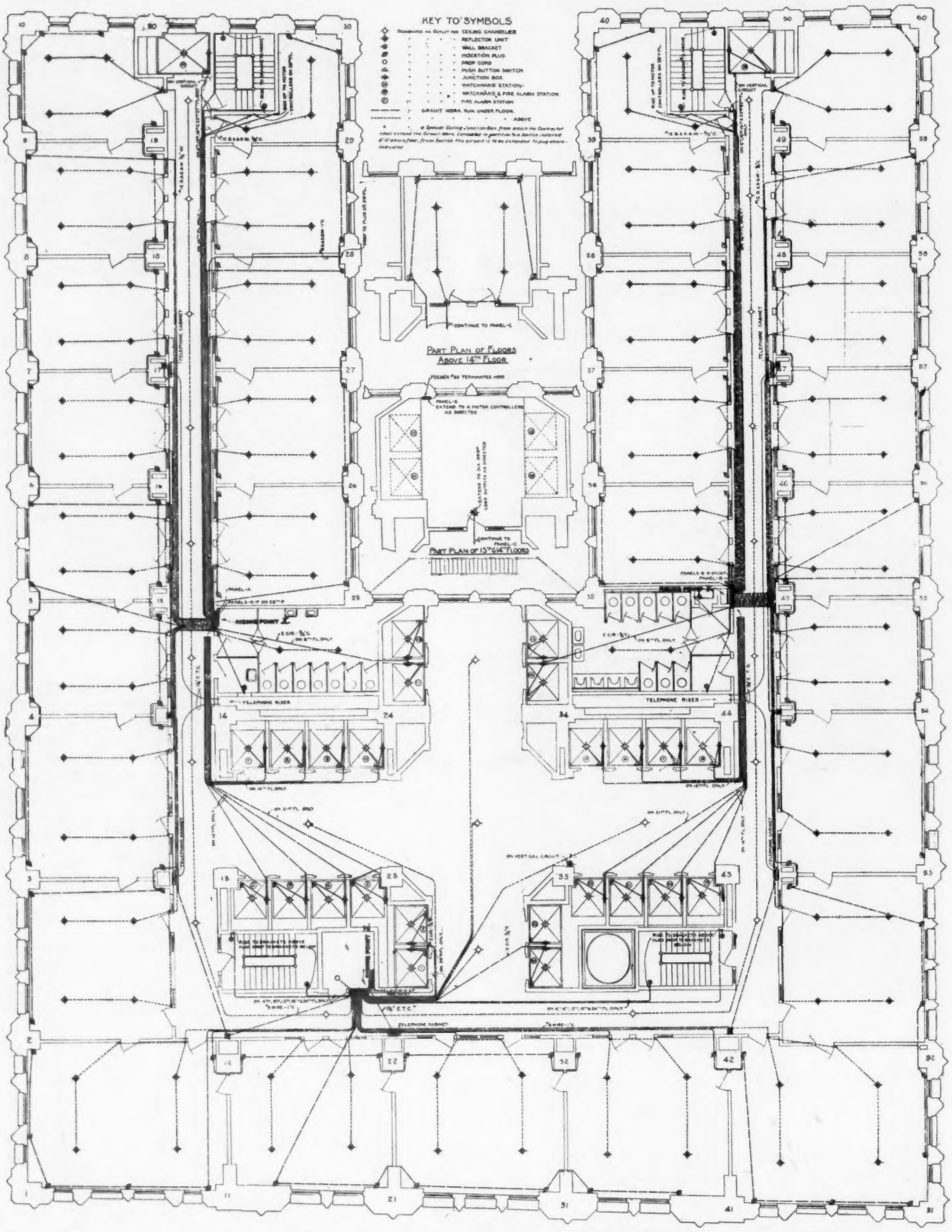


FIG. 11—WIRING DIAGRAM OF A TYPICAL FLOOR

passengers among the cars following. In this way the operators are forced to use every effort to have the cars maintain the predetermined schedule, instead of permitting them to lag behind. It is a matter of common observation that an operator will frequently stop his car at a floor and wait until the car preceding gets ahead of him by four or five floors. By unnecessarily stopping in this manner additional electrical energy is consumed and the number of cars leaving the ground floor in a given time is decreased, the elevator service being therefore correspondingly reduced.

Near the dispatcher's desk is also placed an automatic starting device which sends a signal to all of the cars at both the bottom and top of the hatchway. This timing device can be arranged so as to send a signal every twenty seconds, thirty seconds, or at any other interval desired. The dispatcher may also cut this timing device out of service

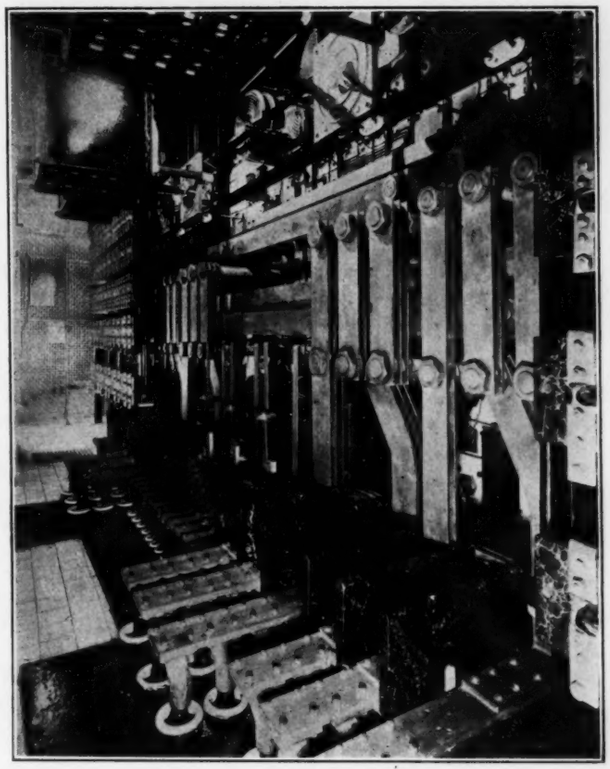


FIG. 12—REAR OF MAIN SWITCHBOARD

for any particular car or group of cars and send the signal himself.

A system of signals has been provided for use at night for two of the high-rise elevators.

The above dispatcher's system has been worked out very completely, and it is believed will increase the efficiency of the elevator service very materially and will bring about a marked change in the method of operation of elevators in tall office buildings.

ELECTRIC GENERATING PLANT

The electrical energy for the building is derived from an electric generating plant located in the sub-basement. The total rating of the plant is 1500 kw, consisting of two 500-kw units, one 300-kw unit and one 200-kw unit.

The engines are all of the tandem compound, non-condensing type, having releasing Corliss valve gear. The engines are designed to operate at an initial steam pressure of 150 lb., with practically no back pressure, and run at 100 r.p.m. Fig. 1 shows a view of the engine room.

The generators are wound for a potential of 250 volts and three balancer units are provided for the three-wire system. Each of two of these balancer sets is designed for a total unbalance of 30 kw, and the third set for 10 kw.

The engines were manufactured by the Providence Engineering Works and the generators by the General Electric Company.

Figs. 13 and 12 show front and rear views respectively of the main switchboard. The central panel of the switch-

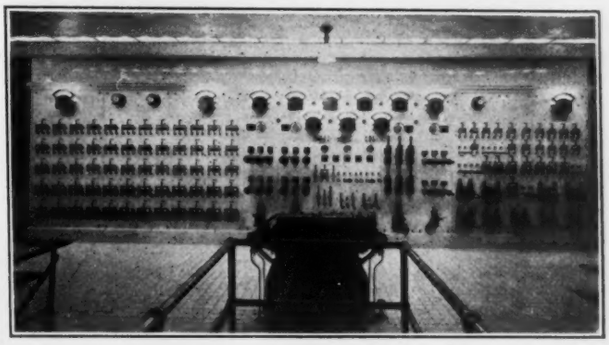


FIG. 13—LIGHTING SCHEME OF MAIN SWITCHBOARD

board is equipped with the various controlling and protecting devices for the balancer sets. The two panels on each side of the central panel serve for the generators. The right-hand panels are equipped with the switches and circuit-breakers for controlling the various motor feeders, and the left-hand panels are equipped with the knife switches for the lighting feeders. The two photographs show clearly the various features of the switchboard without further explanation.

WIRING

Fig. 7 shows the various feeders and centers of distribution for the lighting and motor-service wiring of the entire building. The lighting system is of the three-wire, 125-250-volt type, and the motor service is of the two-wire, 250-volt type. Fig. 11 shows a wiring plant of a typical floor. These two views show generally

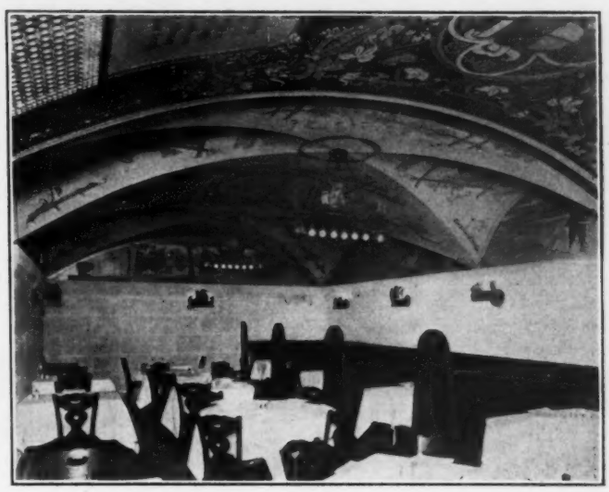


FIG. 14—ILLUMINATION IN RATHSKELLER OF WOOLWORTH BUILDING

the principal features of the wiring system. The total number of outlets installed in the building is in the neighborhood of 12,000 and the installed lighting load is approximately 450 kw. The offices are lighted principally with reflector units, the sizes of the lamps varying from 25 watts to 60 watts. Including the elevator motors, the installed motor load is over 1400 kw.

Phase Compensation—III.

By Val. A. Fynn

Below is given the concluding portion of the article entitled Phase Compensation, the first and second instalments of which appeared in the *Electrical World* July 5 and July 12.

The method of varying the phase of the exciting emf e_3 shown in Fig. 30 is most effective, but, obviously, not always

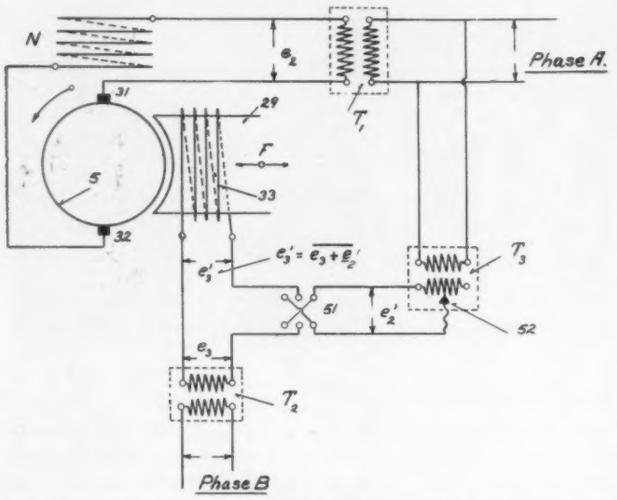


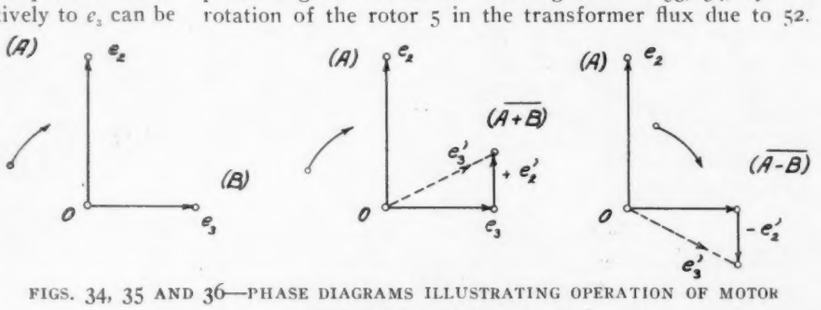
FIG. 33—COMPENSATED CONDUCTION ALTERNATING-CURRENT MOTOR OPERATED FROM A TWO-PHASE SUPPLY

practical. However, the method shown in Fig. 33 can be readily employed, for instance, wherever a two-phase distribution is available. In this figure the motor is supposed to be constituted exactly in the same manner as that shown in Figs. 17, 19 and 30. The emf e_2 impressed on the armature circuit is derived from phase A by means of the transformer T_1, while the exciting winding 33 is fed from phase B by means of the transformer T_2. If the field winding 33 were directly connected to the secondary of T_2, then the phase relation between e_3 and the exciting emf e_3 would be correctly shown in Fig. 34. These two emfs, being derived from different phases of a two-phase supply, must necessarily be in time-quadrature, as shown in that figure, and it is known that under these conditions the motor would operate with a "lagging" power-factor.

The phase of the resultant emf impressed on the exciting winding 33 may be easily changed by impressing on that winding two emfs differing in phase and connected in series. One way of achieving this in practice is shown in Fig. 33, where an emf e_3 derived from phase B is connected in series with an emf e_2' derived from phase A and impressed on the field winding 33. The direction of e_2' relatively to e_3 can be changed by means of the reversing switch 51, and the magnitude of e_2' can be controlled by means of the regulating switch 52 of the transformer T_2. Thus for a position of the reversing switch 51 for which e_3' is of the same direction as e_3, the phase and magnitude of the resultant exciting emf e_3' may be ascertained by the diagram shown in Fig. 35. The component e_3 of Fig. 35 is of the same phase as the component e_3 of Fig. 34, because both are derived from phase B. The component e_2' is of the same phase as e_2 because both are derived from phase A. The resultant exciting emf must therefore be correctly represented as to phase and magnitude by the diagonal e_3' of the parallelogram, two sides of which equal e_3 and two other sides of which equal e_2'. If the connections of Fig. 33 correspond to the assumptions underlying the diagram shown in Fig. 35, then, according to former deductions, the power-factor of the machine will be improved and will continue to improve as the magnitude of the component e_2', to which it is customary to refer as the "compensating emf," is increased. It is easy to see that as e_2' increases, so does the lead of e_3' over e_3 diminish. Similarly, if the direction of e_2' is reversed, by reversing switch 51, then the diagram shown in Fig. 36 will correctly represent the conditions, and it will be seen that the lead of e_3' over e_3 must increase with increasing e_2', thus lowering the power-factor.

The method of varying the phase of the resultant exciting emf described in connection with Fig. 33 is the one made use of by the Wagner Electric Manufacturing Company in its constant-speed so-called "unity-power-factor" motor, but this motor differs somewhat from the one shown in Fig. 33. While the latter is what is known as a conduction machine—that is, one in which the energy required by the rotor is conducted to it—the Wagner machine is an induction motor—that is, a machine in which the energy required by the rotor is conveyed to it by induction without making it necessary to have a conductive connection between the rotor and the source of supply. Another difference between the motor shown in Fig. 39 and the Wagner machines resides in the fact that an exciting emf generated outside the motor by some independent source of supply must be impressed on the exciting winding 33 of the machine shown in Fig. 33 in order to produce any exciting flux at all, while in the Wagner motors a quadrature exciting emf is generated in the machine itself, thus enabling these motors to operate without separate excitation.

The primary form of motor from which the unity-power-factor machine has been derived is shown in Fig. 37, where 52 is the main stator winding adapted to be connected to the mains, while the rotor is short-circuited by means of the brushes 31, 32 along the axis of 52 and by means of other brushes 53, 54 along an axis displaced from that of 52. It has been shown elsewhere, and it is clearly apparent, that the winding 52 is simply the primary of a transformer the secondary of which is the rotor winding 5, closed coaxially with 52 by means of the interconnected brushes 31, 32. As long as the machine is standing still it corresponds exactly to a short-circuited transformer. The fact that the windings of the secondary 5 of this transformer may be revolved is immaterial. The primary 52 will produce a transformer flux TF in line with the axis of 52. This flux will induce in the rotor 5 a working emf e_2 which appears at the brushes 31, 32, causing a current i_2 to flow in the working circuit comprising the brushes 31, 32. If the rotor is brought up to synchronous speed by any desired means, it will be found, as has also been elsewhere explained at some length, that an exciting emf of proper phase is generated at the exciting brushes 53, 54, by the rotation of the rotor 5 in the transformer flux due to 52.



FIGS. 34, 35 AND 36—PHASE DIAGRAMS ILLUSTRATING OPERATION OF MOTOR SHOWN IN FIG. 33

This exciting emf e_3 will produce a current i_3 in the exciting circuit and this current will set up the exciting or motor field MF. It is found that when such a machine operates near synchronism the working emf e_2 induced in the working circuit is of opposite phase to the terminal emf E, and that the exciting emf e_3 acting on the exciting circuit is in phase-quadrature with the working emf e_2.

The foregoing discussion immediately leads to the conclusion that, owing to this quadrature relation of e_3 and e_2, the back emf e_1 appearing in the working circuit and opposing the working emf e_2 induced therein from 52 will be practically of opposite phase to e_2 and that the machine will operate with a "lagging" power-factor—the more so because of the lagging magnetizing current required by the main stator winding in order to produce the all-important transformer flux TF, on the presence of which the entire operation of the machine depends. It has been shown that it is only necessary to alter the phase of the exciting emf in the correct direction in order to cause the power-factor in the working circuit of any motor to be raised to any desired extent or even to be converted into a "leading" power-factor. That being the case, it is only necessary, in connection with the motor shown in Fig. 37 to introduce into the exciting circuit comprising the brushes 53 and 54 and in which an exciting emf e_3 in phase-quadrature with the working emf e_2, and therefore with the terminal emf E, is already present, another emf differing in phase from the exciting emf and of such magnitude and direction as will achieve the end in view. Since the exciting emf e_3, acting in the exciting circuit of this motor, is in phase-quadrature with the terminal emf E, then it is necessary merely to inject into this exciting circuit an emf of the same phase as E and to select correctly the direction and magnitude of this compensating emf e_2'. This result can be readily achieved in the manner shown in Fig. 38 by means of the transformer T_2. The secondary emf of such a transformer must necessarily be of practically opposite phase to the terminal emf E, while its direction relatively to the self-produced exciting emf e_3 generated within the rotor 5 can always be adjusted by means of a reversing switch, such as 51. The magnitude of e_2' can be controlled by means of the regulating switch 52. A comparison of Fig. 38 with Fig. 33 immediately discloses the fact that the methods of compensation employed in the two figures are identical, the compensating emf e_2' in each case being derived from that phase which feeds energy to the working circuit. In Fig. 33 the working circuit is fed conductively; in Fig. 38 this circuit is fed inductively. In Fig. 38 the motor itself produces the emf e_3 required for its excitation; in Fig. 33 this exciting emf is not produced in the motor and is consequently derived from an outside source, such as phase B of the supply.

There remains just one question to settle in connection with Fig. 38. While it is true that by means of the connections shown it is possible to control the phase relation between the current in the working circuit and the emf impressed on that circuit, yet it remains to be proved that by

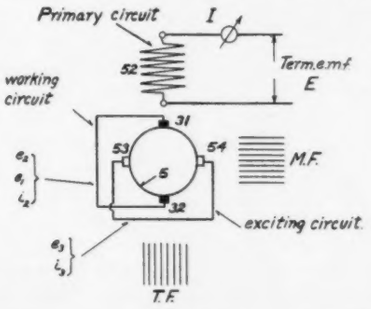


FIG. 37—SELF-EXCITED, SINGLE-PHASE INDUCTION COMMUTATOR MOTOR WITH SHUNT CHARACTERISTIC

so doing it is possible to control also the phase relation of the current I taken by the main stator winding with respect to the terminal emf E. If it be remembered that the rotor along the axis 31, 32 is simply the secondary of a transformer the primary of which is represented by the main inducing winding 52, then it is clear that phase variations between current and emf in the rotor along the axis 31, 32 will be almost exactly reflected in the main inducing winding of the machine. These phase relations would be quite accurately reflected if it were not for the magnetizing current required by 52 in order to uphold the transformer field, which is essential to the operation of the machine. Owing to this magnetizing current in 52, the primary current I will not only always lag more behind the terminal

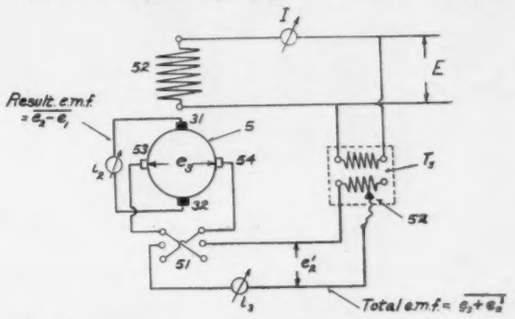


FIG. 38—SELF-EXCITED SINGLE-PHASE INDUCTION COMMUTATOR MOTOR WITH SHUNT CHARACTERISTIC AND ARTIFICIAL PHASE COMPENSATION

emf E than the working current i_2 lags behind the working emf e_2, but it will also lead E by less than i_2 leads e_2. For this reason it will be necessary to cause the rotor current along the axis 31, 32 to lead slightly the working emf along that axis in order to secure phase coincidence between I and E in the primary circuit of the motor. The reason why the phase relations between secondary current and secondary emf are always almost exactly reflected in the primary is that as long as the terminal voltage on the primary of a transformer remains constant it is necessary for the transformer flux, and therefore for the magnetizing current, to remain practically constant. At no load there is no current in the secondary and only the magnetizing current i_0 in the primary. As soon as a current i_2, be it lagging or leading, flows through the secondary, an equal and opposite current $-i_2$ must flow in the primary, in order to counteract all the magnetizing effects due to i_2 and thus retain a constant transformer flux. This condition is very clearly illustrated in the diagrams of Figs. 39 and 40, the first of which indicates the conditions for a secondary curent i_2 lagging by an angle γ behind the secondary emf e_2, while the second shows the conditions obtaining for a lead of i_2 over e_2 amounting to δ degrees. It is seen that in the first instance the primary current I lags behind the primary emf E by more than the angle γ, while in the second instance the primary current I leads the primary emf E by less than the angle δ. This fact leads to the conclusion that the compensating scheme used in Fig. 38 for the purpose of controlling the phase relation in the working circuit of the rotor will also control the phase relations in the primary winding 52 of the machine, or in that winding of the motor which is directly connected to the mains.

While it is quite possible to derive the compensating emf e_2' from the mains in the manner shown in Fig. 38, it is neither the cheapest nor the most convenient manner of doing so. A handier way is shown in Fig. 41, in which the transformer T_2 is practically built into the motor itself, the main winding 52 being made use of as the primary of such transformer, an auxiliary or compensating winding 55 being used as the secondary thereof. It is then necessary only to connect this winding 55 properly to the exciting brushes 53, 54. If desired, the compensating winding 55 may be provided with taps, as shown in Fig. 41, with the help of which taps the magnitude of the compensating emf, and with it the power-factor of the motor, can be adjusted.

It is well known and has already been pointed out that it is possible to cause a synchronous motor to operate with almost any desired power-factor simply by altering the magnitude of the direct-current excitation of the machine. It

is thought that the manner in which phase compensation is secured in these synchronous machines may now be very advantageously viewed from a somewhat different standpoint. It will be easy to see that the principle involved is exactly the same as that set forth in connection with asynchronous motors, although the necessary phase alterations

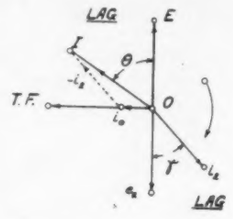


FIG. 39—TRANSFORMER PHASE DIAGRAM FOR LAGGING SECONDARY CURRENT

are brought about in a somewhat different manner; that is, mechanically instead of electrically.

Consider a single-phase generator and an identical single-phase synchronous motor, such as shown in Fig. 42. Let the field magnet 42 of the generator be provided with the field winding 20 and be excited by means of direct current, and let 42 be revolved at a uniform speed of 500 r.p.m. in the direction indicated by the curved arrow, then an emf e_2 will be generated in the armature winding 41 of this generator and may be represented by the vector e_2 of Fig. 43. Let the field magnet 3 of the motor be brought up to the same speed of 500 r.p.m. while excited with direct current by means of the field winding 5, connect the motor armature 58 to that of the generator at the proper time and in the manner shown, and adjust the excitation of the motor until it operates at unity power-factor; that is, until the current I taken by the machine coincides in phase with the working emf e_2 impressed on same from the generator winding 41. Assuming that the generator winding 41 and the motor winding 58 are entirely devoid of local inductance—an assumption which holds true only in the case of an ideal machine—and that the direct-current excitation has been adjusted for unity power-factor, then it will be found that the corresponding relative position of the field magnets 3 and 42 is that shown in Fig. 42. This relative position of the two field magnets is preserved throughout each revolution as long as the machines remain in step; that is, in operation. This condition may be described by saying that the two field magnets are in phase but are oppositely directed, or by saying that they are of opposite phase. This is true since at the instant for which Fig. 42 holds good the north pole of the generator field magnet is directed upward and that of the motor is directed downward, and these magnets retain their parallelism at all times.

Since the instantaneous magnitude of the emf e_2 gener-

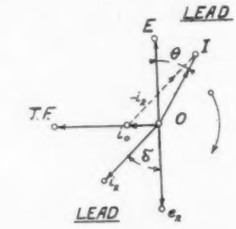


FIG. 40—TRANSFORMER PHASE DIAGRAM FOR LEADING SECONDARY CURRENT

ated in 41 depends at any instant on the position of the field magnet 42 relatively to the points 60 and 61 at which e_2 is measured, then it is clear that the emf e_1 generated in 58 will likewise depend on the position of the field magnet 3 relatively to the points 62, 63 at which e_1 appears. Referring to Fig. 42, it is noted that when the north pole of 42 stands opposite point 60 the south pole of 3 stands opposite point 62; thus if the emf e_2 generated in 41 reaches a positive maximum when the north pole 42 stands opposite point 60, then the emf e_1 must clearly reach a negative maximum at the same instant. It follows that the emf e_1 generated in the motor winding 58 and which is the back of the machine will, for the relative positions of 3 and 42 shown in Fig. 42, oppose at every instant the working emf e_2 generated in 41 and impressed on 58. This condition of things may be represented by means of vectors, in the manner shown in Fig. 43, in which the vector representing the back emf e_1 is shown as being exactly opposed to the vector e_2 representing the terminal or working emf of the motor. It is known that e_2 must be sufficiently greater than e_1 in order to enable the motor to receive enough current to allow it to deal with its load. The resultant responsible for that current in the armature winding 58 of the motor will therefore coincide in direction with the vector e_2 and may be represented by the vector R. On the assumption that the motor is an ideal one, the current I due to R will not lag slightly behind this resultant but will coincide with it, as shown in Fig. 43, and the motor will operate at unity power-factor. The same thing is also indicated in Fig. 42 by means of the arrows marked e_2, R, I and e. The first three are all in line one below the other, thus indicating that they coincide in time and direction; the last is of opposite direction to the first and is so shown.

Now let the direct-current excitation of the motor be weakened. This will immediately reduce the magnitude of the back emf e_1 and cause the current I taken by the motor

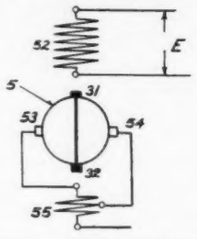


FIG. 41—SELF-EXCITED, SINGLE-PHASE INDUCTION COMMUTATOR MOTOR WITH SHUNT CHARACTERISTIC AND ARTIFICIAL PHASE COMPENSATION

to rise momentarily, thus supplying more energy to the machine than is called for by the load with which it is dealing, with the result that the field magnet will momentarily accelerate its speed in an attempt to reduce the current I by increasing the back emf e_1. Assume that the momentary acceleration of the field 3 alters its relative position to the field 42 by the angle α indicated in Fig. 44. If the field magnet 3 continues to revolve synchronously with the field magnet 42 after having altered its position relatively to the latter in the manner indicated, then it is clear that the back emf e_1 generated in the motor armature 58 will retain its original periodicity, as is imperative, but will reach its maxima ahead of the maxima reached by e_2. The time elapsing between the instant at which e_1 reaches its maxima and the instant at which e_2 reaches corresponding maxima will be proportional to the angle α of Fig. 44, and will represent the phase difference between e_1 and e_2. This phase difference may, therefore, be expressed in the usual way by displacing the vector e_1 of Fig. 43 by the angle $(+\alpha)$; that is, by an angle α measured in the direction of rotation. This displacement of the vector e_1 is shown in the vector diagram of Fig. 45 and immediately indicates that the resultant R, responsible for the current in the motor armature 58, for the new relative positions of the field magnets 3 and 42, shown in Fig. 44, will no more coincide with e_2 as was the case in Fig. 43, but will lag behind e_2 by the angle θ indicated in Fig. 45, causing the current I in the motor also to lag behind its terminal emf by this same angle θ.

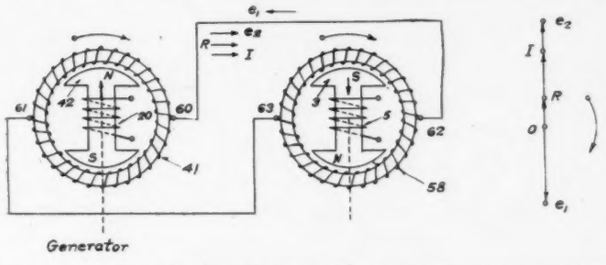
When previously discussing the behavior of synchronous motors it was shown:

(1) That the armature reaction of a synchronous alternating-current motor operating with unity power-factor can merely cross-magnetize the field magnet of such a machine and cannot directly oppose or help the magnetization produced by the field magnet.

(2) That the armature reaction of a synchronous motor operating with "lagging" power-factor produces a magnetization which helps that due to the field magnet of the machine.

(3) That the armature reaction of a synchronous motor operating with "leading" power-factor produces a magnetization which opposes that due to the field magnet of the machine.

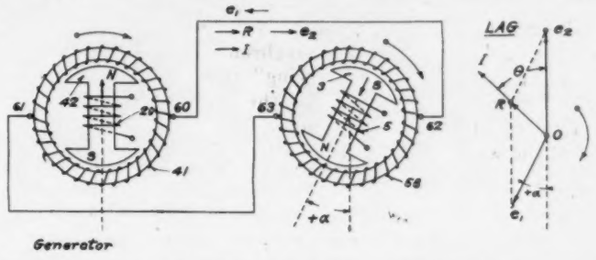
In the case of Fig. 44 it has been seen, with the help of the diagram in Fig. 45, that the weakening of the direct-current excitation of a synchronous motor tends to accelerate the field magnet of the latter, and that the resultant permanent space displacement of the field magnet of the motor with respect to the field magnet of the generator (compare Figs. 42 and 44) so alters the phase of the back emf of the motor as to cause the latter to take a lagging current. This lagging current will help the magnetization produced by the field magnet of the motor and will, therefore, be in a position to bring the total useful magnetization of the machine back to a value at which the back emf will be of such magnitude as sufficiently to reduce the motor current I, even if the motor speed remains constant; that is, even if the machine continues to revolve synchronously.



FIGS. 42 AND 43—GENERATOR AND SYNCHRONOUS MOTOR OPERATING AT UNITY POWER-FACTOR

It follows that as soon as the direct-current excitation of a synchronous motor is weakened, its field magnet will swing forward through an angle α of such magnitude as will enable the lagging current thereby drawn from the generator to increase the useful magnetization of the machine by about that amount by which it was reduced owing to the weakening of the direct-current excitation. This adjustment of the magnetization having taken place, the motor may and will continue, after the above-mentioned momentary deviation, to run at a strictly synchronous speed. A strictly synchronous speed is necessary because the frequency of the back emf of a synchronous motor depends on the speed of that machine and must remain equal to the frequency of the terminal emf.

Similarly, if the excitation of a synchronous motor be suddenly increased, then the magnitude of its back emf will be increased, will reduce the current taken by the machine, thus reducing its torque, and will cause the field magnet 3 to be retarded momentarily. This retardation may, for instance, amount to the angle $(-\alpha)$ shown in Fig. 46, causing the back emf e_1 to reach its maxima some time after the working emf e_2 has reached its corresponding maxima. This time-difference, or phase difference, between e_2 and e_1 will be proportional to the angle $(-\alpha)$ and may be represented, as shown in Fig. 47, by displacing the vector e_1 of Fig. 43 against the direction of rotation through that same angle $(-\alpha)$. A glance at Fig. 47 shows that this new displacement of the field magnet 3 of the motor relatively to the field magnet 42 of the generator causes the motor to take a leading current, and since a leading current taken by a synchronous motor tends to demagnetize the field magnet of the latter, it will be apparent at once that an increase of excitation will cause the field magnet of a synchronous motor so to change its position relatively to the field magnet of the generator feeding the latter as to cause the now

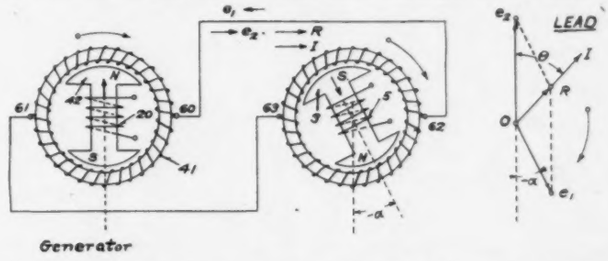


FIGS. 44 AND 45—GENERATOR AND SYNCHRONOUS MOTOR OPERATED WITH LAGGING POWER-FACTOR (MOTOR UNDEREXCITED)

leading armature reaction of the motor to oppose the magnetization produced by the field magnet of the machine to that extent which will allow a back emf of the correct magnitude to be generated by the machine even though it continues to run at a synchronous speed and with an excessive direct-current excitation.

In discussing Figs. 42, 44 and 46, the changes in the position of the field magnet 3 of the synchronous motor have always been referred to the field magnet 42 of the generator driving it, and it has been shown that the space displacement of the field magnet 3, indicated by the angle α, is simply a phase displacement of the exciting flux of the motor relatively to the exciting flux of the generator. Since it has also been shown that the phase of the working emf e_2 produced in the generator always bears the same phase relation to the exciting flux of the latter, then it would clearly be just as accurate to refer the various positions of the field magnet 3 to the phase of this working or terminal emf e_2, instead of to that of the field magnet 42 of the generator. Such a course was followed in previous sections of this paper.

The same conditions may be expressed in many other ways by taking into account the phase relations between the motor flux, the motor back emf and so on, but enough has been said to show that the power-factor of a synchronous motor is controlled exactly in the same manner as that of the non-synchronous motors shown in Figs. 30, 33, or 38 and 41, namely, by altering the phase relation between the working or terminal emf and the exciting or motor flux. In the synchronous machine this change in phase is brought about mechanically by an automatic attempt of the motor



FIGS. 46 AND 47—GENERATOR AND SYNCHRONOUS MOTOR OPERATED WITH LEADING POWER-FACTOR (MOTOR OVEREXCITED)

itself to correct the magnitude of its excitation so as to enable it to deal with any desired load within its range of power while preserving a strictly synchronous speed. Not only does this automatic adjustment take place every time the operator changes the magnitude of the direct-current excitation of the machine but it is also induced by every

change of load on the machine, thus causing the power-factor of a synchronous motor to vary with the load. In the non-synchronous motor there is no occasion for any such automatic adjustment on the part of the machine itself, and none takes place, because of the fact that these motors need not preserve a strictly synchronous speed, a fact already indicated by the word "asynchronous" used in connection with these motors. Asynchronous machines therefore always operate with "lagging" power-factor unless artificial means are provided for the purpose of shifting the phase of the exciting or motor field relatively to the phase of the working emf. Such artificial means have been shown, for instance, in Figs. 33, 38 and 41. In Figs. 33 and 38 they comprise a compensating emf e_2' differing in phase from the exciting emf e_2 and derived from a transformer T_2. In Fig. 41 they comprise a compensating emf (e_2') derived from the compensating winding 55 disposed on the stator of the motor itself.

The Close Measurement of Speed

By Nevil Monroe Hopkins

In the precise measurement of electrical and mechanical values probably no factor has received less serious consideration until recently than what may be termed the precise simultaneous indication of angular velocity or the general subject of scientific tachometry. In the various branches of engineering many refinements have been developed for closely measuring and showing time, temperature, mass, heat units, candle-power, wave-form frequency, volts, etc., and our laboratory textbooks are filled with clever methods of dealing acccurately with various familiar electrical and mechanical measurements; but up to the present time refinements in instruments for measuring speed and their calibration have been very much neglected.

Several years ago the writer set out to produce a scientifically acccurate tachometer, using as a basis for calibrating a shaft of constant angular velocity operated by a small ten-pole synchronous motor controlled by the vibrations of an electrically driven tuning fork kept carefully at constant temperature, and driving the tachometers under study, within a double-walled temperature cabinet fitted with means for heating and cooling and for indicating the temperature not only of the voltmeter movement but of the magneto and connecting leads as well. With this synchronous motor drive and tuning-fork control a progressive increase of load upon the motor will not progressively slow down the shaft. The writer's first problem consisted in the design of a small direct-current magneto capable of giving a straight line rise of emf when operated with the indicating instrument, which was of low resistance and low millivolt full-scale deflection, allowing for a large percentage of manganin to be included in the circuit.

In order to secure permanence of the magneto magnet, long life of operation when subjected to conditions of moisture, dirt and grit, and perfect commutation at all speeds up to 25,000 r.p.m. and higher if desired, a very special design of magneto became necessary. The machine, as finally constructed, consisted of a laminated magnet of thin tungsten steel of the highest grade, with the pole pieces stamped as an integral part of the laminations to avoid any joint which might rust or produce a variable in the magnetic circuit, an armature running within an exceedingly close air-gap, for the sake of permanence, and the armature shaft running upon internal ball bearings entirely separate from those of the main driving shaft. Reduction gears within a water-tight and dust-tight cast-iron shielding case greatly reduced the speed of the main shaft, thereby keeping the armature and commutator within the bounds of smooth commutation at the highest speeds. It will be seen that any wear of the main bearings whose shaft passes through the cast-iron case will not affect the true and close running of the armature and commutator mounted upon the second shaft. It will also be seen that any undue vibrations or end play of the main shaft will not be communicated to the armature and commutator shaft because of the intermediate gear drive. By designing a very long commutator and constructing the commutator bars of platinum or gold, and by supplying several pairs of platinum or gold brushes, connected in parallel, upon each side of the commutator, no variable in resistance is introduced into the circuit as a result of variable brush tension, salt formation or oxidation, as would be the case with copper or bronze, etc.

The Measurement of Peak Voltage

By Henry A. Morss

There appears to be considerable misconception concerning the high-voltage testing of wires and cables. This may be due to the fact that these tests are usually made on open circuit, and, therefore, engineers take it for granted that there are no difficulties because practically no current is required. Such is not the case, however. Owing to the electrostatic capacity of cables of commercial lengths, considerable current is required to maintain the test voltage, and this current by its action on the generator so distorts the wave-form as to render the ordinary voltmeter practically useless.

Of course, the ideal wave-form for high-voltage testing is the sine wave, and if this can be maintained the ordinary voltmeter is sufficient, but when the wave is distorted and the voltmeter still reads only the "square-root of the mean square," it gives very little indication of what is actually happening as regards a breakdown test, for the peak of the wave is what counts so far as the breaking down of insulation is concerned. It follows, therefore, that the strain may actually be much larger than indicated by the voltmeter if the wave is distorted into a high peak, or the strain may be less than indicated if the wave has become flattened.

Experience has shown that under certain circumstances the real strain, which is due to the highest point of the wave, is not indicated at all by the ordinary voltmeter.

The Standardization Rules of the A. I. E. E. require in voltage testing that use be made of an alternating voltage with an effective value equal to the square root of the mean square referred to a sine wave.

In the case of a sine wave, the effective voltage is about 70 per cent of the maximum voltage. Therefore, in cable testing a maximum voltage about one and four-tenths times the required voltage should be used, and the question arises how to determine this under all conditions of testing.

The maximum voltage may be ascertained by means of an oscillograph, but an oscillograph is a delicate and cumbersome instrument for factory use where a large number of tests are made every day. As a result of his study of the problem, the writer concluded that an instrument might be made on the principle of the oscillograph, but with the vibration confined to a straight line, so as to show the limits of oscillation, and thus to indicate the peak of the wave at the end of the line. Such an instrument would be extremely simple to calibrate at any time by applying a known value of unidirectional voltage. This proposition was laid before Prof. F. A. Laws, of the Massachusetts Institute of Technology, and Mr. Chester L. Dawes, of Harvard University. They built an instrument which, although somewhat crude, has achieved the desired result and demonstrated the feasibility of the scheme by a test of three months' use under factory conditions. It would seem that such a peak-voltage-measuring instrument, which is now being developed for commercial service, should have varied uses, for many engineers must be interested not only in the voltage as shown by the ordinary meter, but also in the actual maximum voltage present in generators, transformers, motors or transmission lines.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Employees' Relations with the Public

The Narragansett Electric Lighting Company, of Providence, R. I., recently posted the following notice to employees, with the object of cultivating the best possible relations with the public:

TO OUR EMPLOYEES

Do not forget that you are in the service of the public.
Treat all customers politely and courteously.
Do not try to be smart.
Do not misrepresent anything.
Do not think you are doing the company any favor by beating a customer on a deal.
The motto of this company is "A square deal to the public."
See that you live up to it.

A Woman's Private Electric-Car Livery Service

A lady living at an Eastern summer resort recently underwent financial reverses which threatened to deprive her of her electric automobile, but rather than sacrifice the car at a small price she determined to convert it into a revenue producer. First she had tasteful little folders printed announcing that her car was for hire for shopping trips, etc., and these she distributed at the local hotels.

"My private electric car is at your service," reads the announcement, "for a morning's shopping to the exclusive shops; for a ride out of town; for church-going; for an outing for convalescents; for trips to the theater; for luncheons, etc."

"This electric car," continues the folder, "is ideal for the élite and refined, because it is safe, quiet, clean, comfortable, conservative, luxurious and commodious." The car seats four persons comfortably, including the driver, who is usually the woman owner herself. The rate is $3.50 per hour, with a slightly lower price per hour if the car is hired by the day or half-day.

Two Years' Commercial Effort at Steubenville, Ohio

Since the inauguration of a commercial department at Steubenville, Ohio, May 1, 1911, a remarkable central-station growth has resulted there as indicated by the increase in motor load from 40 hp to 1500 hp, scattered among a number of small customers ranging from 1 hp to 100 hp each. This work was accomplished in spite of the fact that 95 per cent of the motor-service users were formerly operating gas engines for which the fuel supply cost only 25 to 15 cents per 1000 cu. ft.

RESULTS OF COMMERCIAL EFFORT AT STEUBENVILLE, OHIO

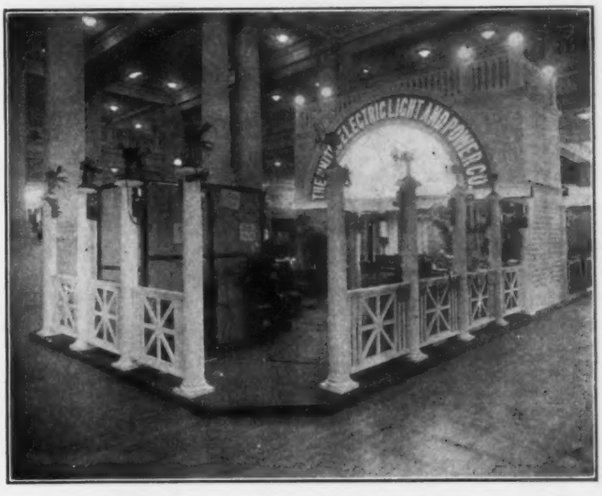
	1911		1913	
	No.	Kw.	No.	Kw.
Motor connections	3	32	76	1200
Commercial connections	260	520	604	1208
Residential connections	240	120	402	201
Flat-rate connections	0	.....	194	19.4
Sign connections	0	.....	61	41
Tungsten clusters	0	.....	120	12
"White Way" posts	0	.....	59	23.6
Irons	25	12.5	300	70
Total		684.5		2775

Among the lighting customers maximum-demand indicators were employed with success, a rate of $4.50 per room being obtained from local contractors for wiring old houses complete with fixtures, lamps and pull-chain sockets. In the accompanying table is reproduced the comparison of central-station data presented by Mr. H. E. Armstrong, of the Tri-State Railway & Electric Company, before the convention of the Ohio Electric Light Association at Cedar Point, July 16, 1913. The company considers Steubenville's "White Way lighting" its most notable achievement, The local business district is lighted by fifty-nine ornamental standards, each carrying five 100-watt tungsten lamps.

But, adds Mr. Armstrong, "the commercial department of any company cannot be a success unless it has every man in the company working for it."

The "Movies" as a Central-Station Load

Realizing that a load of from 35 amp to 60 amp at 110 volts is demanded continuously from early afternoon to late into the evening by the picture mechanism alone of a moving-picture show, the new business department of the United Electric Light & Power Company, under the management of Mr. J. Becker, is making a strong bid for this class of business in New York City. The energy which is required to produce the arc in the lantern is, in an up-to-date picture theater, but a small portion of the load if the appliance and electrical auxiliary salesmen of the central-station company have been attending to their duties.



BOOTH OF THE UNITED ELECTRIC LIGHT & POWER COMPANY

At the booth of the United Electric Light & Power Company which was erected at the first International Exposition of the Moving Picture Art, held at the Grand Central Palace in New York City from July 7 to July 12, the picture show electrical necessities and helpful auxiliaries were tactfully displayed. A standard fireproof booth containing an up-to-date lantern wired to receive energy from

a motor-generator set, a mercury-arc rectifier outfit or a small rotary converter formed the basis of the exhibit, and pictures of a beautiful young lady demonstrating toasting stoves and other electrical appliances served, when upon the screen, to make the booth a stopping place for every passer-by.

In addition to these necessary adjuncts to the picture show, fans, musical bells, ozonators, sign flashers, electric radiators and motor-driven ventilating equipment and household appliances were displayed in conspicuous positions. At times when the picture camera was not in operation the art-glass doors seen in the background of the illustration were closed, hiding the white screen from view. The illuminated sign above the arch was lighted with 5-watt tungsten lamps, which periodically flashed the words "The United Electric Light & Power Company," while the smaller letters at each end of the sign were in service continuously, spelling the words of the slogan of the Society for Electrical Development, "Do It Electrically."

Service Extensions to Bona-Fide Customers

Most companies have had experience with supposed prospective customers who make application for a service extension and then, after the extension is run, are not themselves ready to contract for service. In many cases it is found that such supposed "prospects" had merely signed

APPLICATION FOR LINE EXTENSION.

Agreement made this.....day of.....,. by and between the Springfield Light, Heat & Power Company, herinafter called "Company" and, ...herinafter called "Applicant."

In consideration of the Company making investment to supply Applicant with electricity, the Applicant agrees to have building located at ..... wired ready for Company's meter. If building is not ready for service on date that Company's line is completed, Applicant agrees to pay to the Company, one and one-half ($1.50) dollars each month from date line is completed until Applicant is ready for service.

Service will then be supplied at rates as specified on attached application.

The Springfield Light, Heat & Power Company.

By .....

By .....

Owner of Above Property.

FACSIMILE OF APPLICATION FORM

the application to oblige a neighbor in getting electric light, and that they themselves had no serious intention of taking service. Unless some form of obligation is involved on the part of the applicant, considerable outlay may be made in service-extension investments without resulting business to justify it. To single out the people who are actually sincere in their requests for service, Mr. J. D. North, commercial manager for the Springfield Light, Heat & Power Company, Springfield, Ohio, arranged the accompanying form, by the terms of which the intended customer agrees to pay the company $1.50 per month during the interval from the time service is available until the applicant is ready to use it.

Electricity in a Colorado Hospital

Electricity performs important service in the Red Cross Hospital of Salida, Cal., a town well known to transcontinental travelers via the central Rocky Mountain region as a railroad center and junction point. About 400 incandescent lamps are in use in the establishment, service being supplied by the local central-station company. The operating room is one of the best in the State from the standpoint of electrical equipment and is about 20 ft. by 12 ft. in plan, containing twelve service outlets, an electrically warmed operating table and an instrument cabinet 5 ft. by 5.5 ft. by 1.5 ft. in dimensions, with six glass shelves, two 4-cp lamps being kept lighted constantly to maintain the proper conditions of dryness. Four 100-watt lamps are installed directly above the operating table, and ventilation is facilitated by an 18-in. fan driven by a ⅛-hp, 110-volt motor. In the diagnosis rooms and laboratories electric reflector lamps attached to head bands are in service, and electrically heated instrument sterilizers are in use. A large examination table is provided with four 60-watt lamps, two of which may be cut off at a time. A full line of rheostatic equipment is available for use in connection with cautery apparatus, endoscopes and cystoscopes. An electric stove is employed in heating broth in the kitchen, and an electric toaster is constantly used on the premises. An electric clock system and a complete set of interior telephones, floor bells, corridor, pilot and night lamps are in service, and the nurses' croquet ground is illuminated for evening games by incandescent lamps of 16-cp rating scattered at convenient intervals.

The Meter Tester and His Duties

Of equal importance with the standard used for testing meters is the selection of the tester himself, declared Mr. C. B. Stelle, of the Springfield (Ohio) Light, Heat & Power Company, in a recent paper before a metermen's conference of the Ohio Electric Light Association. Mr. Stelle continued:

"Take the young man who has had a fair education, the one who is building an induction coil or motor, the one who is more interested in the electrical journals than the daily papers and periodicals, even though he did shut down the whole plant on a Saturday evening by trying to electrocute a rat! If there is no one around the plant who is familiar enough with ordinary methods of testing to instruct him, it might be advisable to send him for a month or two to one of the larger companies to act as an assistant and thereby learn to test meters. Then let him test what meters there are in the place usually set aside for this purpose, until you are satisfied that he is familiar with the necessary adjustments and is competent to test any meters he may find on the lines. Even then it will be advisable for him to test the meters of smaller capacity first and gradually work up to the larger ones."

Among the rules which the tester should observe from the start and which from the experience of other companies are most important are:

Notify the customer of the test.

Politeness and good appearance, showing little or no interest in anything but the meter.

Approach the meter as quickly, carefully and quietly as possible.

Ascertain first if the current is on—in small towns the lineman may have that side of the town cut off.

Enter the data, such as "company number," "maker's number," reading, size and type of meter, etc., on suitable card. While getting these data it is well to see if the meter is sealed, and if there is any movement of the meter due to creeping; if so, the time of one revolution should be taken, or if the creep is very small, a quarter or half revolution, from which can be calculated readily the watts represented. If this, however, is due to a bell-ringing transformer or a lamp burning in some part of the house, the meter should be jumped so as not to inconvenience the customer.

Wipe dust and dirt carefully from cover before removing, for failure to do this may show the meter as found "not running" where the trouble was due to some foreign particle having just fallen into the meter.

GRIPPER AND SIDE GUIDE

As there are two adjustments for correctly altering the meter's accuracy, a test under both light-load and full-load conditions is necessary. The light-load condition should be taken first as the meter might not start on light load, while a full load at first might remove the cause of meter not running on light load.

Just about the time the test has been made and results entered, the customer will usually appear on the scene with an exclamation of "How is she?" This is the most critical part of the test, for if the tester says it is slow, he will probably be subjected to a torrent of abuse. If he says "It's fast," the customer will get to the office before he does and things will be mightly uncomfortable for everybody for a while. If the tester says he doesn't know, or that he will have to wait until he gets back to the office to make the calculation, the customer knows he is falsifying.

The best and common practice, declared Mr. Stelle, is to say that instructions are not to give out any information but to refer the inquires to the proper individual in the office. This official, from long dealing with the public in general, is more qualified to handle the situation.

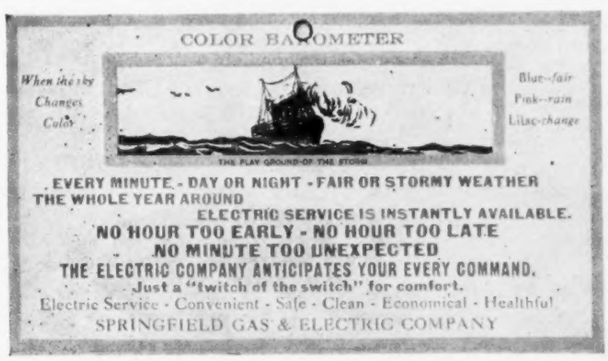
After reconnecting meter, check the readings, replace cover carefully (after cleaning dial glass) and seal meter. Try at least one lamp to see that the circuit has not been left open.

Gather up all apparatus carefully, for it is burdensome for the consumer to let the tester go up to the meter again for a forgotten pair of pliers. "On the way out notify the person in charge that you are through, thank him for some imaginary kindness like showing you to the meter or something similar, and wish him good day. It doesn't cost anything to be polite, but it paves the way to your success as a meter tester. Then go on to the next test."

A Central-Station Barometer

Subsidiary companies of the Federal Light & Traction Company of New York are distributing to present and prospective customers a new advertising novelty which has proved to be one of the most popular publicity "stunts" the company has put out. The card measures 6.25 in. by 3.5 in. and frames a picture on chemically sensitized paper entitled "The Playground of the Storm" and showing a big ocean liner on the high seas. When exposed to dry air the sky of the ocean scene assumes a blue color, changing to pink when the air becomes humid, indicating the approach of rain.

The lower part of the card bears the appropriate re-


COLOR BAROMETER
When the sky Changes Color
Blue—fair
Pink—rain
Lilac—change
THE PLAY GROUND OF THE STORM
EVERY MINUTE - DAY OR NIGHT - FAIR OR STORMY WEATHER
THE WHOLE YEAR AROUND
ELECTRIC SERVICE IS INSTANTLY AVAILABLE.
NO HOUR TOO EARLY - NO HOUR TOO LATE
NO MINUTE TOO UNEXPECTED
THE ELECTRIC COMPANY ANTICIPATES YOUR EVERY COMMAND.
Just a "twitch of the switch" for comfort.
Electric Service - Convenient - Safe - Clean - Economical - Healthful
SPRINGFIELD GAS & ELECTRIC COMPANY

BAROMETER USED AS AN ADVERTISING NOVELTY

minder: "Every minute—day or night—fair or stormy weather—the whole year around, electric service is instantly available. No hour too early—no hour too late—no minute too unexpected—the Electric Company anticipates your every command. Just a twitch of the switch for comfort. Electric service—convenient—safe—clean—economical—healthful." Then follows the name of the company.

A "Living-Picture" Window Display

The Lexington Street and Park Avenue show windows of the Baltimore Gas & Electric Company have been attracting much attention during the last few weeks by the alternating exhibition of a wax dummy figure of "Liberty" and by a living imitation of the wax dummy. The human figure held his position immovably for fifteen minutes at a

WINDOW DISPLAY AT BALTIMORE

time, arousing the greatest of curiosity on the part of the public outside, who wagered among themselves whether they were looking on flesh or waxwork. Only when the poser stepped from his position and his place was taken by the inanimate dummy were all of the people convinced. A 500-watt lamp was held in the figure's hand, and the idea of "the Goddess of Liberty enlightening the world" rapidly "caught on" in the public's mind.

Besides the tungsten-lamp exhibit illustrated, the company has also been using the mechanical doll in connection with displays of electric irons, fans, vacuum cleaners and washing machines. These never failed to draw crowds, as the demonstrator cleverly imitated the mechanical movements of an automaton. At other times both the real dummy and its living prototype appeared in the window, it being quite impossible to tell which was which, especially as their positions were changed from time to time. Mr. Dorsey R. Smith devised the displays described.

Electric Operation of Household Drying Closets

An application of electric power which is highly appreciated by housekeepers is the drying closet, used in connection with the laundry.

Such a closet, as described by Prof. F. C. Caldwell, of Ohio State University, Columbus, in his paper on electrical applications before the Ohio Electric Light Association convention, July 16, makes use of an electric fan to blow heated air through the closet. The heating is usually done with gas, though in the matters of both safety and convenience and in the dryness of the air electrical heat would be much to be preferred. Such drying closets built of steel can be purchased, but very good results can be obtained from an ordinary closet properly fitted up. Professor Caldwell has had one in his own home for several years, he said, and it has proved most satisfactory.

The mangle, or ironing machine, motor-driven and electrically heated, is another laundry helper that deserves more consideration than it has so far received, he said. Here again it is a problem of demonstrating its applicability to the ordinary household.

GRIPPER AND SIDE GUIDE

than the direct-current multiple lamps. For this reason, it little difference what the candle-power of the light source

Illumination and Wiring

Work of Electrical Department, Sanitary District of Chicago

Some interesting points were brought out in an address before the City Club of Chicago on July 11 by Mr. A. B. Gates, testing engineer of the Sanitary District of Chicago, who gave a brief account of the hydroelectric development of the District in a symposium on street lighting. The speaker said that the hydroelectric development of the Chicago Drainage Canal was put in service in 1907, with a connected load of 165 hp in the town of Cicero. A year later the connected load was 15,278 hp, and it has grown steadily since until at the close of 1912 it amounted to 51,846 hp. This connected load is about equally divided between municipal and commercial users.

Mr. Gates called attention to the fact that the Electrical Department of the Sanitary District, co-operating with the Department of Electricity of the city of Chicago, is entitled to credit for a number of important changes in electric street-lighting practice. Perhaps the most important of these was the development of the long-life, series, alternating-current 10-amp flame-arc lamp. When this lamp was first considered for Chicago there was no lamp of the type on the market and it was only after considerable experimental work in which the engineers of the Sanitary District were actively engaged, that such a lamp was produced. Another interesting feature of the present lighting system of Chicago was the adoption of the series-tungsten lighting for residential districts, converting old gas-lamp posts into standards for tungsten lamps enclosed in opalescent spherical globes. A third feature is the special raising and lowering device for arc lamps, which saves time and expense in trimming and repairing lamps, and insures the men against possibility of electric shock.

Lighting the Park-Like Streets of Washington, D. C.

Mr. Walter C. Allen, district electrical engineer of Washington, D. C., gave an illustrated luncheon address before the City Club of Chicago on July 10. His subject was "The Lighting of the National Capital." Prof. Harry McCormack, of the Armour Institute of Technology, presided and in a few opening remarks said that the chemist, as well as the electrical engineer, is entitled to credit for the modern advancement of illuminating engineering. To prove this he cited the use of the Welsbach mantle and the tungsten filament.

Mr. Allen said that all street-lighting service in Washington, D. C., is purchased from three companies—two gas companies and one electric-service company. The outstanding characteristic of the illumination of the streets in the national capital is the use of 100-watt tungsten lamps enclosed in opalescent glass balls mounted singly on slender fluted iron posts of graceful design. This low-intensity street-lighting service has given most satisfactory results. It was adopted largely on account of the fact that almost every street in Washington is generously provided with shade trees. In some cases there are four rows of trees in a single street or avenue, giving the beautiful park-like character to the streets of Washington which is so well known. The 100-watt lamp units are usually staggered, and in that case are 66 ft. apart, measuring in a straight line along the axis of the roadway. Occasionally, however, they are arranged in parallel fashion, with the lamps on each side of the street opposite each other, and in this case the longitudinal distance between lamps is 75 ft. Two heights are provided, one bringing the center of the globe 12 ft. above the surface of the street and the other 10 ft. 3 in. The posts are utilized for street signs.

About 18 miles of streets are now lighted by these single-lamp 100-watt units. There is, however, considerable arc lighting. In the case of the tungsten-lamp standards the lamps are mounted in upright positions in the globes, as tests made by the Bureau of Standards showed that there is practically no difference in efficiency between this position and the downward mounting. Energy is conveyed to the tungsten street lamps by single-conductor lead-covered underground cables laid at the curb and practically at the surface, being protected by strips of wood. Tile ducts are used only at street crossings and other exposed places. The cost of installing these 100-watt tungsten-lamp units is $45 per unit, exclusive of the post and globe, the figure named covering the lamp, fittings, cable, and labor. The maintenance cost varies from 25 cents to 40 cents a front-foot per year.

Pennsylvania Avenue, from the Capitol to the White House, is to be lighted with luminous-arc lamps mounted on specially designed standards having globes consisting of spherical frames with glass in segments. Lamps taking 6.6 amp each will be used, and they will be placed about 100 ft. apart on each curb. The initial cost will be about $70 each and the maintenance cost about $92.10 a year. Luminous arcs, with posts and globes of similar design, will also be used in the plaza about the union railroad station. The numerous bridges in and about Washington receive special treatment from the lighting point of view. For instance, Nernst lamps are used on the handsome concrete bridge over Rock Creek in line with Connecticut Avenue. The standards employed are very elaborate and cost $500 each. It is an interesting fact that in Rock Creek Park, a 1600-acre tract left largely in its natural state, there is no artificial lighting of any kind.

High-Pressure Gas Lighting in Europe and America

In the course of an address on "Street Lighting by Gas Here and Abroad," before the City Club of Chicago on July 11, Mr. F. Victor Westermaier, consulting gas engineer, of Philadelphia, stated that a large area of the Panama-Pacific International Exposition, San Francisco, 1915, will be lighted by high-pressure gas. Mr. Westermaier argued for an abundance of light for city streets, and cited the example of Berlin, which, he said, is the most modern city in the world. He described the 4500-cp three-mantle high-pressure gas street lamps used in some of the streets of Berlin and said that lamps of similar type are used in London and Paris. The gas used by the municipality in Berlin costs about 40 cents a thousand, but is not of very good quality. As a rough measure of comparison he said that 2000-cp high-pressure gas lamps, on the operating basis used in Berlin (that is, two mantles burning from dusk until 1 a.m. and one mantle burning from 1 a.m. until dawn) cost 325 marks or about $81.25 a year. This includes operation and maintenance. He compared with this the 12-amp twin arc lamp on all-night service as used in Berlin and said the latter cost 575 marks ($143.75) a year for operation and maintenance, with electricity at 2.5 cents a kw-hr. Mr. Ray Palmer, city electrician of Chicago, said that in that city, with 80-cent gas and electricity obtained from the Sanitary District at an approximate of 0.5 cent a kw-hour, it was found that gas for a 50-cp gas lamp cost $10 a year and that electricity for an 80-cp series tungsten lamp cost $2.11 a year. Under the Chicago conditions, therefore the comparison was greatly in favor of electricity.

Mr. A. B. Gates, testing engineer for the Sanitary District of Chicago, pointed out that it is not fair to compare the cost of operation of the multiple direct-current arc lamps used in Berlin with the series alternating-current flame-arc lamps in Chicago, for the reason that the latter are of the long-burning type and therefore cut down the cost of maintenance; furthermore, they are more efficient

than the direct-current multiple lamps. For this reason, it does not follow that a saving could be effected in Chicago, under local conditions, by using high-pressure gas lamp in place of the present long-hour series alternating-current flame-arc lamps supplied with energy from a municipal waterpower plant.

Fundamental Principles of Head-Lamp Illumination

BY L. C. PORTER AND K. W. MACKALL

There is at present considerable agitation throughout the country in regard to the use of the locomotive head-lamp. The question of whether a locomotive shall carry a head-lamp throwing a beam powerful enough to illuminate the track a long way ahead or one merely powerful enough to serve as a marker is very largely under discussion at this time and has occasioned the expression of varied opinions on the relative merits of the two methods.

FIG. 1—DIFFERENT SIZES OF FILAMENTS, EACH OF 32 CP

Each class of lamps has its drawbacks and also its advantages. Where single-track roads are in use the powerful head-lamp seems to be advantageous; on double-track roads, equipped with extensive block signals, a powerful head-lamp may momentarily blind an engineer on an approaching locomotive. Tests have also shown that under certain conditions a powerful head-lamp may distort the colors of signals, owing to reflection from the glass roundels. It is probable that a head-lamp of intermediate power would be desirable—a head-lamp which would avoid the glare and reflection of the extremely powerful electric units and yet throw a stronger beam than the present oil lamps.

For the purpose of assuring greater safety to the traveling public, certain states have passed legislation (pending in others) regarding the use of head-lamps on locomotives passing through those states. This is an excellent move. However, as there is relatively little reliable information at present on this subject, great care should be exercised in securing such legislation as will accomplish the desired object. The question of how the law shall read is of vital importance.

At present such legislation is in force in the states of North Carolina, Montana, Indiana, Iowa, Oklahoma, South Dakota, Texas and Arizona. Bills on the subject have been presented and defeated in the states of Colorado, Kentucky and Illinois. Legislation is pending in California, Nevada and Pennsylvania. In several instances the law reads that the locomotive shall carry a head-lamp of at least 1500 unreflected candle-power.

The primary object of a head-lamp is, of course, to illuminate the track ahead of the locomotive. It makes little difference what the candle-power of the light source itself may be, so long as that ultimate result is accomplished. It is the desire of the authors to show that this may be done by the use of proper reflectors or lenses, or a combination of the two, with light sources far below 1500 cp; also that so powerful a light source, if backed by reflectors, may be detrimental to railroad operation, as suggested above. It is also intended to point out in this article the fallacy of the law, as worded, from the standpoint of track illumination.

The beam obtained from any head-lamp depends on three things, namely, (1) concentration of the light source into the focal point of a reflector or lens; (2) shape and condition of reflector or lens; (3) candle-power of the light source. These three conditions are placed in the order of their relative importance.

RATIO OF THE BEAM INTENSITIES OF VARIOUS INCANDESCENT LAMPS

Kind of Lamp	Relative Beam Candle-power
No. 1—Carbon regular	1.0
No. 2—Carbon stereopticon	2.0
No. 3—Carbon stereopticon	5.2
No. 4—Tungsten stereopticon	12.4
No. 5—Tungsten concentric helix	13.4

A head-lamp beam varies in two ways—in intensity and in spread. One beam may throw an extremely narrow yet very powerful pencil of light. Obviously such a beam would not be so serviceable as one not quite so intense but spreading over a greater area of the track.

In order to study the effect upon the resultant beam of concentration of the light source, special incandescent lamps were made up having filaments of varying concentrations, as illustrated herewith, but each of 32 cp. Each lamp was backed by the same reflector and the beam candle-power of the combination measured. The ratio of the beam intensities was as shown in the accompanying table. From this it will be seen that the beam candle-power, and consequently the track illumination, varies with the degree of concentration of the light source, and the more nearly the light source approaches the ideal point source of light, the more powerful the beam will be.

However, as the light approaches a point source, the spread also decreases. As a light source must have an appreciable size, there will be two rays of light striking each point of the reflector, coming from the extreme edges of this source; and since the angles of incidence and reflection must be equal, the angle between these two rays will determine the extreme spread of the beam. Hence neither an actual point source nor one of no concentration would produce the best head-lamp arrangement, but rather a source somewhere between these two extremes.

To study the effect of a reflector on the resultant beam,

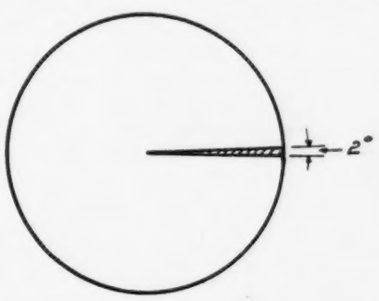


FIG. 2—RESULTANT BEAM WITHOUT REFLECTOR

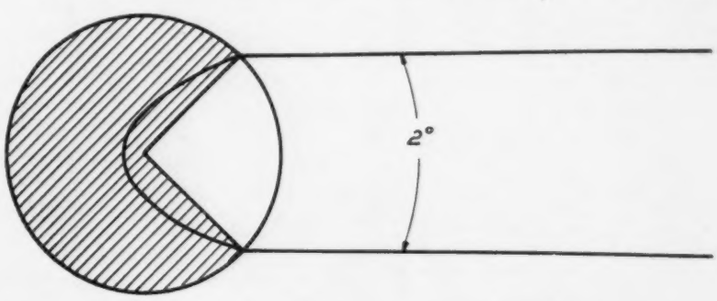


FIG. 3—RESULTANT BEAM WITH REFLECTOR

assume that a beam having a 2 deg. spread is desired; then by using a light source without a reflector it is seen that only a very small portion of the total light flux generated would be utilized. On the other hand, suppose that in back of this light source there be placed a reflector that will give a beam of 2 deg. spread, a very much greater percentage of the total light flux will be utilized, and consequently a more powerful beam will be obtained. In each case the light utilized is represented by the shaded portion of the circle. The diameter and focal length of the reflector also determine, to a large degree, the percentage of total light used and spread of the beam.

The collection and effective projection, or redirection, of rays which are emitted from the light source in all directions produce the powerful beam; thus the selection of the proper lens or reflector is all-important. It is also important that the lens or reflector be kept highly polished and free from dirt.

At a distance of several hundred feet the diameter of a head-lamp becomes negligible in comparison with the distance; hence the whole head-lamp may be considered as a point source of light. Now, the intensity of light from a point source varies inversely as the square of the distance from that source. From all this it is seen that a light of 1500 unreflected cp (horizontal) will give an intensity at 1000 ft. of $\frac{1500}{(1000)^2} = 0.0015$ ft.-candle, which is far too low to enable a motorman or engineer to see an object the size of a man.

Tests made by several railroads seem to indicate that it is necessary to throw an intensity of from 0.05 to 0.1 ft.-candle on a man in dark clothes to make him visible at from 800 ft. to 1000 ft. on a railroad track, the actual intensity required depending somewhat on both atmospheric conditions and the color contrast between the object and the background against which it is viewed.

A 4-amp magnetite head-lamp, consuming 320 watts at the arc, gives from 550 to 650 unreflected cp. This light source backed by a polished parabolic aluminum reflector gives a beam candle-power of 70,000 candles, and at 1000 ft., the intensity will be $\frac{70{,}000}{(1000)^2} = 0.07$ ft.-candle. This same light source placed behind a semaphore lens 12 in. in diameter and of 7-in. focus gives approximately 125,000 cp. At 1000 ft. the intensity will be $\frac{125{,}000}{(1000)^2} = 0.125$ ft.-candle. Head-lamps having concentrated filament tungsten lamps for light sources have been made and have easily accomplished similar results.

Summarizing, it appears that laws requiring 1500 unreflected cp are misleading and really mean nothing where track illumination is concerned. A better specification for a head-lamp would be one which should have an average beam candle-power of not less than 100,000 measured at a distance of not less than 500 ft. over a 2-deg. spread. This is a concrete figure and one that can be met by head-lamp manufacturers. A law so worded would permit of perfect safety at high speeds.

Recent Telephone Patents

Repeater Circuits

The problem of designing a repeater circuit that will be equally efficient when operating in either direction is difficult because of the mutual reaction of repeaters so connected resulting in line noises. A patent recently granted to Messrs. E. W. Preston and G. L. Nickerson, of Sioux City, Ia., describes a means of overcoming this difficulty by arranging a single repeater for use in both directions. By means of relays the relation of the receiving and transmitting parts to the line is adjusted in accordance with the direction in which transmission is proceeding at any particular instant. The relays must be sensitive to the small impressed currents on either section of the line. In order that these weak currents may be effective in operating an electromagnetic relay, one-way repeaters are associated with each section of the line so that each of these may cause a sufficient magnification of received currents to effect the operation of the relay controlling the main-line repeater.

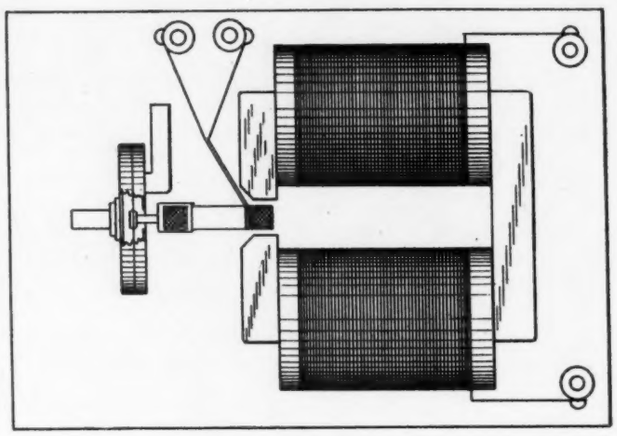


FIG. 1—REPEATING APPARATUS

In Fig. 1 is shown a repeating apparatus patented by Messrs. P. L. Jensen and E. S. Pridham. It will be seen that there is a circular coil disposed within the magnetic field of two co-operating field magnets and attached to the microphonic button. The pull exerted by the moving coil is not only a function of the field created by the received current but also of the strength of the permanent magnetic field. It is also a function of the length of conductor perpendicular to the lines of force. Weak telephone currents in the moving coil may effect a considerable pull on the microphone button.

Exchange Systems

With automatic systems it is usually necessary for a subscriber to go through a complete manipulation of the dial of the instrument before obtaining talking connection with any party on the system. This becomes a disadvantage in case of emergency. To overcome this, Mr. A. E. Keith, of Hinsdale, Ill., has invented an arrangement by means of which, as soon as the receiver is removed from the switch-hook of the automatic instrument, a talking circuit is established with an employee of the telephone company whose duty it is to respond to any demands made at this time. The system is arranged so that as soon as the dials are moved for the purpose of establishing a regular exchange connection the connection with the special employee is cut off. The patent for this system has been assigned to the Automatic Electric Company.

Mr. C. L. Johnson, of Chicago, has obtained two patents relating to the use of party lines in connection with automatic systems, the particular feature sought being the removal of any possibility of one station on the line inadvertently interfering with the establishment of switches from the other station. According to one of the patents the operation of any station is dependent upon the response of a polarized magnet of high resistance. If any station is using the line, its low resistance shunts the control magnets of all the other stations. The second patent describes a system whereby the mutual control between the stations of the party line is effected by means of an additional circuit parallel to and independent of the talking circuit. This circuit is arranged so that no station can interfere with

another. Both of these patents are assigned to the Corwin Telephone Manufacturing Company.

Another patent granted to Mr. Johnson and assigned to the Corwin company relates to ringing on party lines operating on automatic systems. This patent provides a trunk circuit such that the calling subscriber may control the ringing by opening his circuit. As the ringing takes

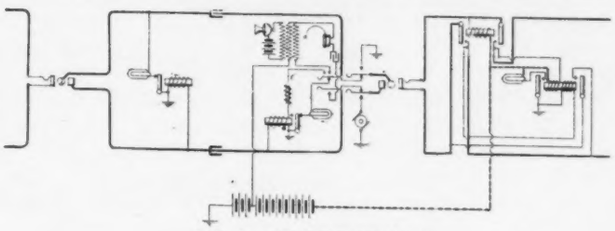


FIG. 2—CIRCUIT SYSTEM

place when the calling party's circuit is open, the calling station has no effect in shunting the line.

A switchboard circuit system invented by Mr. E. R. Hobbs, of Buhl, Idaho, is of the two-wire, common-battery type, it having been the designer's endeavor to arrange such a circuit system so that the line will be free from clicks upon the response of the operator and further so that there will be no chattering of the cut-off relay during ringing. Fig. 2 shows how this is accomplished by making the cut-off relay close the connections to the jacks before severing the line relay connections, and by associating the cut-off relays between the tip side of the line and ground, while all ringing currents are applied upon the ring side of the line. A further feature of the system is the establishment of the "busy" condition upon the jack sleeves as soon as a calling subscriber lifts his receiver. This is accomplished through an auxiliary contact of the line relay.

Another circuit system for common-battery multiple switchboards has been patented by Messrs. D. L. Temple, of Chicago, and C. L. Goodrum, of Atlantic City, and is assigned to the American Electric Company. In this system two-wire plugs and cords are used, but the jack wiring is of the three-conductor type. The line relay is doubly wound, one of the windings alone being inserted during the calling condition. This winding energizes the relay and lights the line lamp. Upon the insertion of a plug in the jack two of the jack springs become short-circuited, thus placing the two windings of the line relay in parallel and releasing the armature through differential action. The supervisory relays are three in number. The single control-relay circuit is completed through a retardation coil placed between the subscriber's line and battery, while individual supervisory relays are associated with the plugs on the tip side of the line. The control relay closes both supervisory lamp circuits, while each supervisory relay serves to open the corresponding lamp circuit.

A combined fire-alarm and telephone system is the subject of a patent granted to Mr. W. W. Dean, of Chicago. The usual code-wheel fire-alarm apparatus is located upon the subscriber's premises, the moving code wheel serving to introduce current impulses upon one side of the telephone line. The telephone line is carried through a triple-wound induction coil at the central office. Two of the windings are connected into the respective limbs of the line in differential relation. The third winding is inductive to that one of the line winding which carries the code-wheel impulses. These code-wheel impulses therefore become induced in this tertiary winding, the terminals of which are connected to a relay sensitive to such impulses. The contacts of this relay in turn control the circuit of the alarm bell and Morse recorder.

A party-line system designed by Mr. E. R. Corwin is arranged so that if any station is using the line a relay of any other station attempting to do so will open both transmitter and receiver circuits of the offending station.

Letter to the Editors

Progress of the Jovian Order—The Electrical Fraternity

To the Editors of the Electrical World:

SIRS: The elecrical fraternity now known as the Jovian Order was formed at Austin, Tex., May 20, 1899, having a charter membership of forty-four, with the name "The Order of Rejuvenated Sons of Jove," and as an emblem a representation of Lucifer in scarlet upon a white field. At the annual meeting held in Pittsburgh in October, 1912, the name was changed to the "Jovian Order," and a representation of the classical head of Jove surrounded by a circle, with the words "The Jovian Order" and "Co-operation," was adopted as an alternate emblem.

Statistics are at best but barren reading, yet it is believed that the figures in the accompanying table are not entirely devoid of interest to men associated with the electrical industry. They have at least the merit of being given in this manner for the first time. They show in concrete form the progress of the order in gaining candidates and emphasize clearly the struggles of its early days.

DATA ON JOVIAN MEMBERSHIP

Jovian Period, Year	DATE		NUMERICAL DESIGNATION OF NEW MEMBERS	
	From	To	Potentials	Number Admitted
First.....	5-20-99	10-15-99	1 to 44	44
Second....	10-16-99	10-15-00	45 to 56	12
Third.....	10-16-00	10-15-01	57 to 66	10
Fourth....	10-16-01	10-15-02	67 to 103	37
Fifth.....	10-16-02	10-15-03	104 to 116	13
Sixth.....	10-16-03	10-15-04	117 to 178	62
Seventh...	10-16-04	10-15-05	179 to 219	41
Eighth....	10-16-05	10-15-06	220 to 578	359
Ninth.....	10-16-06	10-15-07	579 to 1,128	550
Tenth.....	10-16-07	10-15-08	1,129 to 1,812	684
Eleventh..	10-16-08	10-15-09	1,813 to 2,490	678
Twelfth...	10-16-09	10-15-10	2,491 to 3,548	1,058
Thirteenth	10-16-10	10-15-11	3,549 to 4,865	1,317
Fourteenth	10-17-11	10-15-12	4,866 to 8,400	3,535
Fifteenth..	(6½ months	expired)	8,401 to 10,407	2,007

The Jovian Order is not on trial, with need to justify its existence, and it requires no defense. However, individuals who have not had opportunity to perfect their knowledge of its aims and work may question its right to expect their co-operation and support. To any doubt felt by these the record as indicated in the table should be more than sufficient reply. When ten thousand men of one industry support a cause that has survived the test of fourteen years, the doubter may safely embrace it without strict examination. If, however, numbers alone fail to convince, an investigation of the personnel of this vast membership would surely do so, revealing as it would that included in the roll are not alone those of humble position and influence but numerous influential and learned men active in making history in the electrical industry to-day. All the men in the profession having national and international fame, with few exceptions, are Jovians. The Jovian roster in each city includes the men of large achievement there, the executives of central stations, street railways, telephone, manufacturing and jobbing companies, all meeting upon common ground under the mantle of Jovianism.

Concerning the serious purposes of Jovianism for the enlightenment of those who still have the erroneous impression that it plays a part no deeper than that of first comedian in the drama of electrical development, no more convincing argument of the earnestness and sterling character of Jovian tenets can be found than the slogan of the order: "All together, all the time, for everything electrical,"

and its avowed purposes, as incorporated in its constitution, as follows:

"The foundation of the Jovian Order was inspired by a desire to bring the devotees of the science of electricity and of its kindred schools into a closer communication and companionship, to the end that information and learning might be more generally and effectually diffused; that love and pride of profession might be instilled in every heart, brotherly feeling engendered, and that ties and links be forged at the anvil of Vulcan which shall lengthen until the chain encircles the globe, thus cementing forever its membership in a common bond of interest, which shall include the loftiest savant and the humblest aspirant.

"The object of this order is the cultivation of the spirit of fraternity and good-fellowship, from which may be evolved practical plans of commercial co-operation for the promotion and popularization of electricity in the world's work."

Surely the above is broad enough to satisfy the most ambitious of commercial Don Juans.

As stated in that part of the Jovian constitution just quoted, the prime object of the order is to bring together upon common ground the men engaged in electrical and kindred industries; to bring them together in such a manner and amid such surroundings that the too frequent suspicions and animosities which impede and embitter much of our commercial intercourse may be forgotten, that the path to profitable industrial co-operation will be opened by social commingling and made easy to traverse to the ultimate goal of pleasure and profit in the labor of every worthy man.

The most efficient agent for the realization of this object, at one time considered merely a Utopian dream, is the "Jovian league" or "Jovian luncheon club." There are today in active operation fifty-one of the leagues, avowedly Jovian, in nearly all the large cities in United States and Canada, and probably six or seven "electrical clubs" not including the word "Jovian" in their names but owing their existence to the order, with their officers, committees and members largely Jovian. The roster of the leagues vary from 50 to 500, a conservative average being slightly more than 100.

These clubs are not of a "hit or miss" character, with no more worthy object than an excuse to assemble men occasionally at luncheon, but all have definite schemes of operation and thorough organization. In a majority of the clubs the local Jovian statesman is the presiding officer, although this practice is not made obligatory by the rules of the order. The executive management is undertaken by a president, a vice-president, a secretary-treasurer and an executive committee of five. The work outlined by them is accomplished usually by entertainment, reception, publicity, public affairs and other committees appointed by the president and made up of the most influential and active men of the local electrical industry.

Without exception in every city where these leagues have been put in active operation there has been evident at once a marked improvement in electrical trade conditions. They have proved the value of, generated and fostered the "get-together" doctrine, have stopped or at least abated destructive competition and price-cutting, and by bringing men of the same industry together socially to discuss their affairs in a friendly spirit have eliminated much bitterness and antagonism. Specific examples could be cited where these clubs have been the direct cause of a funeral ceremony over the hatchet that had for years ruthlessly chopped the pleasure and profit from the relations between the central station, the contractor and the dealer.

At meetings of the Jovian leagues, held weekly or bi-weekly, educational possibilities are not overlooked, it being the duty of the entertainment committees to furnish speakers for thirty-minute after-luncheon talks on subjects of interest to the members. These talks have resulted in the dissemination of much useful information and have served as a clearing house for the exchange of ideas and the discussion of problems of the profession or of local conditions.

In several cities the leagues through their public affairs committees have originated and are pushing to consummation legislation which will greatly benefit the electrical industry locally. In other cities the leagues are co-operating with local civic bodies in campaigns for the advancement of movements conducive to the public good, thus in a broad manner furthering their own interests and bringing the whole electrical industry into even higher repute. The committees have been successful in securing much desirable publicity in the daily press throughout the United States and Canada, as well as in the technical electrical publications, the latter being exceedingly generous in recording the efforts of the order.

Conceding the advantages of affiliation with the order, a number of the most powerful electrical leagues, not originally organized as Jovian bodies, have adopted new constitutions making them such or have reached the same result by consolidation with the local Jovian club. Notable examples of this condition are to be found in Pittsburgh, St. Louis, Cleveland and San Francisco. In some cities there still exist separate organizations, but it is hoped and believed that they too will eventually realize the greater strength of one concrete body supported by an international order more than ten thousand strong.

The past and present officers of the Jovian Order are fully cognizant of the tremendous possibilities for practical benefit to the electrical industry inherent in the Jovian luncheon leagues and feel that in the further development and rounding out of the present system of operating them lies the assured realization of Jovian doctrines. Every possible effort is being made to foster and encourage the existing clubs and others are being organized wherever the Jovian membership is sufficiently large. There will be not fewer than sixty-five active clubs reporting to the order at the expiration of this Jovian year.

If a contingency should ever arise where it would be beneficial to the electrical industry to put into effect a gigantic educational campaign or powerful concerted effort for certain national legislation, the trained and efficient artillery of these clubs can be simultaneously brought into action with a resultant cannonade that will prove irresistible.

At first limited to the confines of Texas, then spreading over the entire United States, the Jovian Order continues to press onward and, although often spoken of as a "national" body, has long since graduated into the international class through its Canadian and Mexican chapters.

The order publishes a monthly magazine, known as *The Jovian Bulletin*, of from thirty-two to fifty-two pages, printed upon good paper, profusely illustrated with half-tone engravings, containing a complete record of all the happenings within the order and all news which can be gathered concerning the activities of Jovians in Jovian work or otherwise. Data concerning conventions, a free employment bureau, an "exchange" for the interchange of ideas and text matter of general interest are also included. This magazine is mailed without charge of any kind to each member of the order on the twenty-fifth of each month.

Now to sum up, and it shall be but a brief conclusion:

First, the Jovian Order has a well-defined purpose, big and broad and sincere, and practical enough with relation to the betterment of trade conditions in the electrical industry amply to justify its existence and the steadfast support of every man having the welfare of that industry at heart.

Second, its methods of accomplishing this purpose have improved and strengthened, its membership has increased and its organization has been better perfected with each succeeding year, until now beyond any doubt it is a staff sturdy enough to support him who will use it honestly to his coveted goal and to a better understanding of himself and his fellow-man.

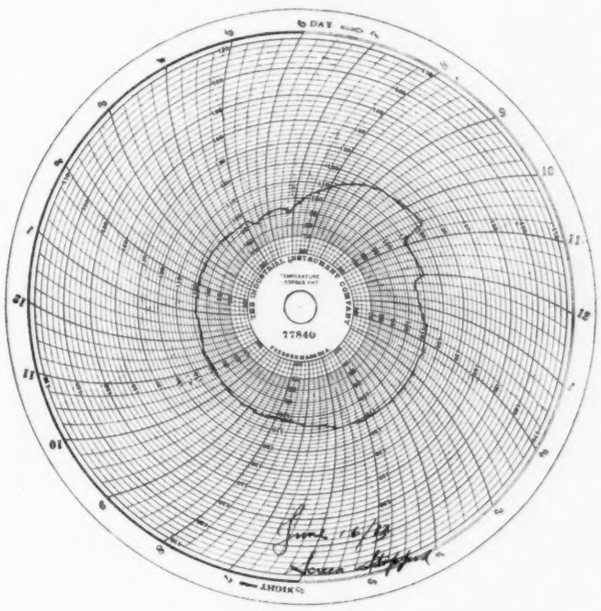
St. Louis, Mo. Ell C. Bennett.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Locating Defective Turbine Ventilation Graphically

The accompanying chart taken from a Foxboro recording thermometer installed in the power plant of the Jenckes Spinning Company at Pawtucket, R. I., illustrates how by close observation of such records serious troubles in operation may be forecast and often prevented. The thermometer is installed in the field of a 1000-kw turbo-generator. On the day shown an abnormal increase in temperature occurred between 8 a. m. and 9 a. m., soon attracting the attention of the operating force. Search for the trouble disclosed that the screen on the turbine fresh-air intake outside the power plant building was clogged with lint. As soon as the latter was removed the temperature dropped 12 deg. and after a second cleaning a further 6-deg. drop was obtained. On account of the increased load the temperature rose to 112 deg. at about 2 p. m., later falling to the normal as the output was reduced, the plant being operated day and night. By the use of this recorder, which was built by the Industrial Instrument Company, Foxboro, Mass., the textile plant was saved a possible interruption of a costly character.



THERMOMETER CHART

Requirements for Efficient Burning of Oil Fuel

By R. T. Strohm

The first essential for the successful burning of crude oil or fuel oil is that it must be atomized or broken up into a fine spray or mist; next, it must be thoroughly mixed with a sufficient amount of air to insure its complete combustion, and, finally, the combustion must take place in a furnace of suitable size and shape. These three requirements must be met in every power plant in which liquid fuel is to be used.

When crude oil was first tried as a fuel for steam boilers, attempts were made to burn it by running it into shallow pans and igniting its surface. This was simply following the old methods applied in the case of coal. For, as the coal was spread out in the form of a bed of fairly uniform thickness on the grates, so was the oil spread out in a shallow sheet. This method, however, was wholly unsatisfactory and unsuccessful and was soon abandoned. The reason for its failure was that oil differs so greatly from coal.

With coal the effect of the heat is to drive off the volatile matter in the form of gases, which, mixing with the air passing through the bed of fuel, burn and generate sufficient heat to ignite the solid carbon remaining on the grates. This bed of burning carbon then furnishes the heat required to ignite succeeding charges of fresh fuel.

With oil, there is no incandescent bed of fuel. The oil does not burn in the liquid form. Before it can burn it must be changed to a vapor, or volatilized, and this is done by the action of heat. The action may be illustrated by the burning of a common wax candle.

When the wick of a candle is lighted the heat due to the burning melts some of the wax just below the flame, and the melted wax is at once carried up the wick by capillary action. As it comes closer to the flame it grows hotter and hotter, until at length it reaches the boiling point and passes into vapor. This vapor mixes with the air and thus forms a combustible mixture, which burns above the tip of the wick. Part of the heat due to its burning is used to melt and vaporize more of the wax, and the burning is thus rendered a continuous process.

FLAME OF WAX CANDLE

It will be observed that the flame of a candle varies in color. Just around the tip of the wick there is nothing to be seen. This transparent section *a* is the vaporized wax, before it has had a chance to mix with air and burn. Around this is another transparent section *b* that has a bluish tinge. Here the vapor has mixed with some air and is being partly burned. Farther up, there is more opportunity for the mixing of a sufficient quantity of air, and the flame there becomes yellow or yellowish white.

That part of the flame that is tinged with blue indicates incomplete combustion, because the supply of oxygen in the air that mixes with the vapor is not sufficient to burn the carbon to dioxide. This portion of the flame does not have so high a temperature as the yellowish portion where the combustion is complete.

As a further experiment to show that the crude oil will not burn in the liquid form, a live coal or a blazing stick may be dropped or thrust into a vessel containing the oil. Instead of firing the oil, the live coal will be quenched or the flame of the stick will be extinguished by the oil, for the simple reason that the oil is vaporized so slowly that the inflammable gas produced is not sufficient to support continuous combustion.

The object of atomizing the oil, or dividing it into a fine mist or spray, can now be understood. By separating the body of oil into a great number of fine particles, each particle will have its surface exposed to the heat and will be

more readily vaporized than a large bulk of oil. The finer the mist or spray, the more easily will the vaporizing occur. This can be shown by a very simple example. If oil is broken up into a series of drops each 0.1 in. in diameter, the ratio of the surface area to the volume of each drop is sixty to one. But if the drops are 0.01 in. in diameter, the ratio of area to volume is 600 to 1. That is, a drop of oil 0.01 in. in diameter will expose ten times as much surface per unit volume as a drop 0.1 in. in diameter. The finer the particles, therefore, the greater will be the amount of external surface per unit volume exposed to the action of the heat and the more rapidly will the oil turn to vapor.

When the oil has been properly vaporized, it must be thoroughly mixed with air in the correct proportion to produce complete combustion. This may be done by allowing the air to enter the furnace through openings in the floor or the ash-pit, somewhat after the manner in which it is admitted to the furnace of a coal-burning boiler. Again, it may be admitted through the same opening as those through which the burners are introduced, in which case the air sweeps over the burners. But it is more than probable that both methods will be used at one time, so that part of the necessary air will be admitted by each.

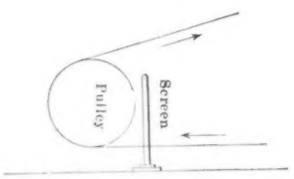
The third requirement for the efficient use of oil fuel is a furnace of suitable design and construction in which the combustion may take place. The common furnace used for solid fuel will not ordinarily answer the purpose without alterations.

The coal-burning furnace can be fired intermittently, for there is always a bed of incandescent fuel on the grates, so that when the fresh coal is added the incandescent portion will fire the green fuel. But the injection of the liquid fuel is continuous, and the conversion of the freshly admitted oil from the liquid to the gaseous state must be accomplished by a part of the heat of the oil that was burned just before. As there is no fuel bed, the heat must be stored in the lining of the furnace. In other words, the furnace is lined with firebrick, which becomes highly heated and acts as a heat reservoir and equalizer.

The chamber in which the combustion of the liquid fuel takes place should not be bounded by cold metal surfaces. For if the partly burned gases strike such surfaces they will be chilled, combustion will be checked, and there will be a loss of heat and probably the formation of smoke. By having the combustion occur in a firebrick furnace, however, the chilling is prevented, and when the gases have been burned completely they may be led against the boiler tubes and surfaces without danger of producing smoke.

Safety Screen Protection Against Moving Belt

In the older plants of the country there exist no more dangerous conditions than those about the moving belts so generally employed in stations designed twenty years ago.

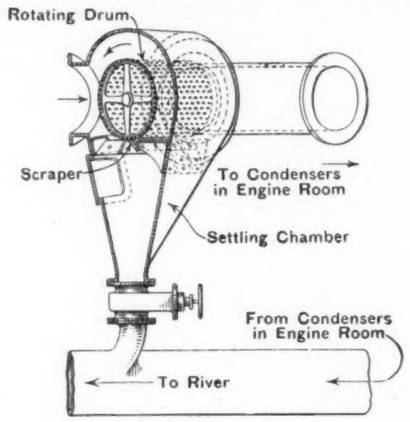


SAFETY SCREEN FOR MOVING BELT

There are attendants to-day who will reach into these man-killers and wipe off the pulley surfaces while belts and pulleys are running at full speed. A little lapse or carelessness, and the man's sleeve, or his rag and hand, may be drawn between pulley and belt, tearing the arm from its socket and probably killing the man. The best rule, of course, is the positive one of handling the pulley only when it is shut down. A screen like that shown in the sketch should be installed on the approach side of every large high-speed pulley in which a limb is likely to get caught. Such a screen will arrest the member before it can be crushed between belt and wheel.

Rotating Strainer for Condensing-Water Intake

An unusual form of rotary strainer-screen is employed in the condenser-intake lines of the famous Deptford central station, London, the design having been made by the engineers of the London Electric Supply Corporation, which operates the plant. The strainer proper consists of a drum, perforated with many small holes, which rotates in a cast-iron housing at the rate of about 3 r.p.m., being driven from the centrifugal-pump shaft through reduction gearing. Leaves, straw or other débris entering with the water adhere to the outside of the drum, and are removed by a fixed scraper, the position of which is seen in the figure. This is adjusted so as to have a "shaving" action on the drum surface, so that any solid matter may also be effectively removed. Thence it gravitates through a duct



ROTATING STRAINER-SCREEN

at the back of the scraper into the lower part of the housing which acts as a settling chamber. From this it is returned to the river through a sludge valve, connected to the return pipe from the condensers, and opened either automatically or by hand.

These rotating screens were built in the corporation's own shop and represent the fruit of many experiments. They have given satisfactory results and in initial cost represent about one-third of the investment required for other strainers.

Where Step-up Transformation Would Not Pay

We have a prospective 160-kw load in 60-cycle, three-phase induction motors located 3300 ft. from our plant which generates at 480 volts. What size cable will we have to install to carry this load, or would it pay to use step-up and step-down transformers? The allowable power loss is 8 per cent to the 440-volt motor terminals. C. E. F.

To deliver 160 kw at 440 volts requires 210 amp per phase at unity power-factor; or 263 amp per phase allowing 80 per cent power-factor for inductive load. With 8 per cent power loss allowed for the entire line, the loss per phase wire would be 4267 watts. With a current of 263 amp this loss will result from a resistance of 0.0625 ohms, represented by each 3300-ft. line conductor. Hence our conductor should have a resistance of 0.019895 ohms per 1000 ft. of length. Now 600,000-circ. mil cable has a resistance of 0.0175 ohms per 1000 ft. and will therefore fulfil the conditions. The cost of such a 440-volt cable would be less than that of installing transformers alone, not including the cost of the high-tension line.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Electrolytic Iron in the Construction of Electric Machines.—MAX BRESLAUER.—The conclusion of his paper in which the author figures the saving in material which can be obtained by the use of electrolytic sheet iron instead of alloy steel sheets in the construction of transformers and dynamo-electric machines. This saving is due rather to the higher permeability of the electrolytic iron than to its lower hysteresis losses. It is shown that in transformer design the utilization of the material may be increased by from 33 to 40 per cent. Attention is called to the fact that losses in electrolytic iron are influenced considerably by the temperature because the temperature coefficient of electrolytic iron is higher by 50 per cent than with special alloy steel sheets. During overload machines built of electrolytic iron are less liable to be damaged than the other machines since with increased temperature the iron losses decrease. In the construction of direct-current machines electrolytic sheet iron may be used advantageously in the yoke only; it is thought, however, that it might be employed advantageously also for the commutation poles.—*Elek. Zeit.*, June 19, 1913.

Three-Phase Commutator Motors.—SCHOENBURG.—An article on the use of the three-phase commutation motor for driving intermittently operating machines in steel mills, etc., especially for rolling mill motors and crane motors.—*Elek. Zeit.*, June 19, 1913.

Phase-Advancing.—An account of the discussion which followed the reading at Birmingham of the paper by Kapp, lately mentioned in the *Digest.*—London *Electrician*, June 27, 1913.

Lamps and Lighting

Fluctuations of Candle-Power of Alternating-Current Lamps.—G. W. MEYER.—A brief article on the fluctuation of the candle-power during one period of an alternating-current incandescent lamp. The fluctuation effect depends not only on the frequency but also on the wave-form of the alternating current. To suppress the flicker effect the filament should be made of sufficiently high heat capacity or reactance may be connected in series. Some references to literature on the subject are given.—*Elek. und Masch.* (Vienna), June 15, 1913.

Ductile Tungsten Filaments.—A note on three recent British patent (5026, 5027 and 5028 of 1912), of J. Hubers and Julius Pintsch, A.-G. The first specification describes a process in which a compound of tungsten is mixed with between 1 per cent and 5 per cent of an oxide or an equivalent proportion of a compound of thorium or other rare earth metal, an alkaline earth metal or magnesium or zirconium, or a mixture. The mass is squirted and reduced in hydrogen, so as to avoid the formation of crystalline particles. The metals are finally alloyed together. Likewise colloidal tungsten may be used. In the second specification processes are covered for compressing the preliminary ductile filament, obtained as above described, by passing it through drawstones or rollers and subjecting it to drawing or rolling. According to the third specification, a thick wire or rod is formed from the paste, as in specification 5026, 1912, and is drawn or rolled.—London *Elec. Eng'ing*, June 26, 1913.

Ductile Tungsten Filaments.—A note on a recent British patent (12,752, 1912) of M. M. Hubers, executrix of the late J. Hubers, and Julius Pintsch A.-G. The carbonization and decarbonization of the filaments, produced as above in a reducing atmosphere, is effected with filaments of long aggregate length, and is carried out in one step. The filaments are cut to length after ductile filaments are obtained.—London *Elec. Eng'ing*, June 26, 1913.

Drawn Tungsten Filaments.—A note on two recent British patents (12,244 and 12,469, 1912) of C. Gladitz. In the first specification a construction of press molds which permits of pressing the bar in such a way as to avoid the possibility of cracking, is described. The tungsten powder used is of a fluffy character, and the press mold simultaneously releases the compressed air in all three directions, so that it can expand unrestrictedly. The second specification deals with a method of preparing the end of the wire so that it can easily be inserted into the draw-plate, for drawing into filaments, without twisting taking place. A long tapering of the wire at the end is effected by treatment in an electrolytic bath containing a strongly oxidizing electrolyte. The end to be treated is stretched and hangs vertically in the electrolyte; it is connected as the cathode, and is gradually withdrawn upwards.—London *Elec. Eng'ing*, June 26, 1913.

Generation, Transmission and Distribution

Capacity of Transmission Line.—G. P. MARKOVITCH.—The first part of a long mathematical paper in which, after a general introduction on the capacity of transmission lines and the definition of partial capacities, the author first discusses a three-phase line with the three conductors symmetrically arranged and then passes over to a three-phase line with the three conductors non-symmetrically arranged. The vector diagrams and formulas in these cases are given. The article is to be continued.—*Elek. und Masch.* (Vienna), June 22, 1913.

Electric Distribution for Mines.—J. W. ANSON.—A long abstract of a paper read before the South African Institute of Electrical Engineers giving a description of the conditions likely to be encountered when installing an electrical plant in the South African mines, and advises on the class of plant which is best able to fulfill these conditions.—London *Electrician*, June 27, 1913.

Preventing Corrosion in Boilers.—An illustrated article on the Cumberland process in which iron anodes are suspended in the water contained in the vessel to be protected and a small current is caused to flow from these anodes to the metal work to be protected as cathode.—London *Electrician*, June 27, 1913.

Traction

London.—A. J. LAWSON.—An article giving statistical data of London passenger traffic in the past year and former years on the London County Council tramways, the Metropolitan electric railways, and motor omnibuses. A comparison of fares is given as well as some data of cost of operation of motor omnibuses.—London *Electrician*, June 27, 1913.

Installations, Systems and Appliances

Austria-Hungary. — EMIL HONIGMANN.—Continuation and conclusion of his long statistical article containing many tables on the condition of the electrical industries in

Austria-Hungary and import and export trade.—*Elek. und Masch.* (Vienna), June 8 and 15, 1913.

Wires, Wiring and Conduits

Copper and Aluminum Cables.—B. Welbourn.—A long abstract of a paper read before the (British) Institute of Mining Engineers. The author after dealing with the mechanical, physical and electrical properties of aluminum and copper, gives figures showing the cost of each for various systems of electrical transmission. In a table is given a comparison of the physical, mechanical and electrical properties of aluminum and copper. It is stated that so far aluminum cables have not been used in British mines. From a table giving a comparison of prices of medium-presssure three-core copper and aluminum cables with paper insulation and lead sheath for three-phase currents it appears that the aluminum cable is the cheaper (a) in plain lead-sheathed cables whenever aluminum wire bars are less than $110 per ton above the price of copper bars; (b) in single-wire armored cables whenever aluminum wire bars are less than $50 per ton above the price of copper bars; (c) in double-wire armored cables whenever aluminum wire bars are lower in price than copper bars. Another table gives a comparison of prices of medium-pressure single-core copper and aluminum cables with paper insulation and lead sheath, and it is shown that for plain lead-sheathed cables aluminum cables are less expensive than copper cables if the aluminum wire bars cost less than $210 per ton above the price of copper wire bars. A similar comparison is given for analogous cables with bitumen insulation. Another comparison is made between 0.20 sq. in. paper-insulated three-core 3000-volt copper conductor, lead-sheathed and double-wire armored cable 470 yd. long with its equivalent aluminum cable and it is found that in this case the aluminum cable cannot compete either in price or in weight. Finally overhead lines are discussed. The first cost of overhead transmission lines of stranded aluminum conductors of 0.10 sq. in. sectional area and upwards, with spans up to 400 ft. (the maximum usually employed in the United Kingdom), is less than for lines of copper conductors. A comparison of the cost of a 6600-volt, three-phase, 25-cycle line to carry 1000 kw. for ten miles under British conditions, constructed of copper and aluminum, is given. This shows an approximate saving of 16.5 per cent in favor of aluminum. An account of the discussion which followed the paper is also given.—London *Electrician*, June 20, 1913.

Impregnated Poles.—R. Nowotny.—An article on the behavior of different kinds of wood when subjected to impregnating processes and on the modification of impregnating processes required to get equally good poles from different kinds of wood.—*Elek. und Masch.* (Vienna), June 15, 1913.

Electrophysics and Magnetism

Multiple Reflection of Short Electric Waves from Screens of Metallic Resonators.—W. L. Severinghaus and W. S. Nelms.—The results of multiple reflection of electric waves from selective resonator screens are very similar to those of multiple or selective reflection in the infra-red. Multiple reflection affords a practicable and easy method of obtaining short electric waves having a very definite period, less damped than the oscillator and free from "mirror action" and other disturbing influences. The damping coefficient for resonators, whose width was negligible compared to their length, was found to be about 0.15, which agrees with the theoretical value, whereas the experimentally determined coefficient is about 1.4 for the Righi vibrator. Resonators can be made to oscillate in their first overtone; that is, with a frequency twice that of the fundamental.—*Phys. Review*, June, 1913.

The Reflection of the X-Rays.—H. G. J. Moseley and C. G. Darwin.—An account of an experimental investigation, the chief results of which are as follows: X-rays "reflected" from crystals have the general properties of ordinary X-rays. The radiation from an X-ray tube with platinum target is of two kinds, (A) radiation of indefinite wave-length, analogous to white light, and (B) five types of monochromatic radiation, probably characteristic of the platinum. The radiation (A) is reflected at all angles of incidence. The reflection has been studied at different angles, and the results have been interpreted. Each of the radiations (B) is reflected only at special angles. These angles have been measured with three crystals, and the results are in good agreement with the simple theory deduced from the principle of interference. An attempt is made to estimate the distribution of energy in the wave-lengths for the general X-rays.—*Philos. Mag.*, July, 1913.

Electrochemistry and Batteries

Constitution of Atoms and Molecules.—Albert C. Crehore.—A long and very elaborate paper on the formation of the molecules of the elements and their compounds, with atoms as constituted on the corpuscular-ring theory. The author starts from J. J. Thomson's hypothesis of the constitution of an atom of a mass of positive electrification within which negative electrons are revolving. According to the number of electrons in an atom there are more or less rings of electrons in an atom. The various configuration for 1 to 100 electrons are given in a table. The author then describes experiments in which he tried to imitate the forces acting between the electrons in an atom and studied their resulting configuration. In his model the electrons were represented by spheres charged electrostatically and each sphere was suspended as a pendulum from a common point by long conducting fibers or wires. If the deflection is small compared with the length of the pendulum, so that the value of the angle does not differ appreciably from its sine, the force of gravity tends to return each sphere to the center or lowest point with a force proportional to the deflection, and by this means the positive electrostatic sphere in the atom is simulated by the weight of the spheres. If the spheres are equally charged with electricity of the same kind and the distance between adjacent spheres is large compared with their radii, then the force of repulsion between any two of them is inversely proportional to the square of the distance between them. This meets the second required condition, and such an arrangement should give the required equilibrium figures. Details are given of the arrangement of the experiments and some modifications, which permit one to vary the configuration of the electron spheres. He finally succeeds in producing experimentally exactly such configurations as are required theoretically from Thomson's hypothesis. From these experimental results he then finds the relative radii of the orbits of the various electrons and their exact positions for equilibrium in an atom. These are then used to deduce the constitution of molecules. He shows that atoms come to definite positions of stable equilibrium with each other at fixed distances, thus forming the molecules of compounds. The diatomic molecules consist of two atoms rigidly held at fixed distances apart resembling the well-known dumb-bell molecule which has been deduced from the theory of heat. The reason that carbon may unite with more hydrogen atoms than nitrogen, and nitrogen with more than oxygen, and oxygen with more than fluorine becomes apparent. The last part of the paper contains a mathematical theory of the subject.—*Philos. Mag.*, July, 1913.

Constitution of Atoms.—N. Bohr.—According to Rutherford's theory an atom consists of a positively charged nucleus surrounded by a system of electrons kept together by attractive forces from the nucleus; the total negative charge of the electrons is equal to the positive charge of the nucleus. According to J. J. Thomson's theory an atom consists of a sphere of uniform positive electrification, inside which the electrons move in circular orbits. The prin-

cipal difference between these two atom-models consists in the circumstance that the forces acting on the electrons in the atom-model of Thomson allow of certain configurations and motions of the electrons for which the system is in a stable equilibrium; such configurations, however, apparently do not exist for the Rutherford atom-model. The present author shows that the application of Planck's radiation theory (principle of elementary quanta of action) to Rutherford's atom-model affords a basis for a theory of the constitution of atoms. The mechanism of the binding electrons by a positive nucleus is discussed in relation to Planck's theory. It is possible from this point of view to account in a simple way for the law of the line spectrum of hydrogen.—*Philos. Mag.*, July, 1913.

Specific Inductive Capacity and Atomic Charges.—FERNANDO SANFORD.—The author has called attention to the fact that if the mobilities of ions, calculated from electrolysis, be multiplied by their respective ionic masses numbers are obtained which are closely related to many of the physical and chemical properties of the ions. Among these are all the properties of bodies which depend on cohesion or affinity. In the present paper their relation to specific inductive capacity, refractive power and magnetic rotatory power are shown in some cases.—*Phys. Review*, June, 1913.

Electric Tube Furnace.—R. E. SLADE.—An illustrated Royal Society paper describing an electric platinum tube furnace for experiments in vacuo at temperatures up to 1500 deg. C.—London *Electrician*, June 27, 1913.

Units, Measurements and Instruments

National Physical Laboratory.—The conclusion of last year's report of the work of the British National Physical Laboratory relating especially to the investigations on the unit of light, visibility of light, metallic-filament lamps, alternating-current power measurements, heating of lamp sockets, insulating materials, testing work, primary batteries, and electric cables.—London *Electrician*, June 27, 1913.

Torsion Dynamometer.—H. GOERGES AND P. WEIDIG.—The first part of an illustrated description of a simple mirror dynamometer which combines convenience of measurements with accuracy. The principle is shown in Fig. 1. *B* is a concave mirror and *C* a plain mirror, both *B* and *C* being mounted on the rotating axle. D_1 and D_2 are two plain mirrors stationary in space. The lamp *A* sends rays to *B* which are reflected to D_1, D_2, *C* and finally are reflected by *C* into the telescope. If the focus of the concave mirror *B* is so chosen that the point *E* where the real

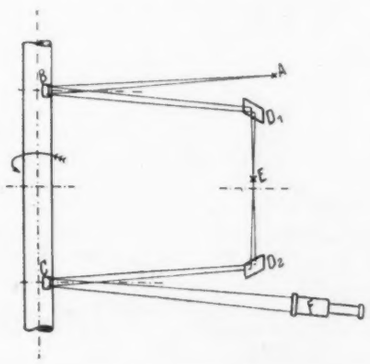


FIG. 1—PRINCIPLE OF TORSION DYNAMOMETER

image appears is about the central point in the path of the rays between *B* and *C*, a sharp stationary image of the source of light is obtained in the telescope, independently of the fact whether the axle is rotating and with what speed it is rotating. If it rotates slowly the image appears at regular intervals, always at the same point, while with rapid rotation the impression in the eye is that of a quiet permanent image. If now the two cross-sections where the mirrors *B* and *C* are mounted are distorted against each other (as in the case of the torsion dynamometer) the image is displaced in the telescope and soon disappears from the field of vision. It may be rendered visible again by displacing either the lamp *A* or the telescope *F*. From the amount of this displacement, the torque can be easily

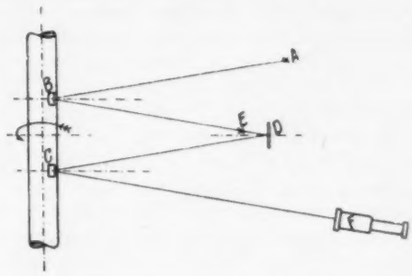


FIG. 2—SCHEME FOR USING SINGLE STATIONARY MIRROR

determined. If the two rotating mirrors *B* and *C* are not too far distant from each other, a single mirror, *D*, stationary in space may be used instead of the two mirrors D_1 and D_2. In this case, which is shown in Fig. 2, the real image should be near the mirror *D*. If *C* is replaced by a concave mirror it is possible to produce a real image of *E* and project it on a scale which then replaces the telescope *F*. On the other hand the mirror *B* may be replaced by a plain mirror and a lens. The construction of the instrument and its theory are discussed at some length. The article is to be concluded.—*Elek. Zeit.*, June 19, 1913.

Resistors.—In last year's report of the (British) National Physical Laboratory it is stated that the 10-megohm "resistance box" has now been completed. The resistor is built up out of 100 coils, each having a resistance of 100,000 ohms. The coils are mounted in sets of five on brass rods, every two such sets constituting one megohm, being brought out to separate terminals. The general arrangement of the coils and the terminal pillars is shown in Fig. 3. The ebonite terminal pillars are continued some distance below the ebonite base in order to increase the leakage path between the terminals. The joint between the ebonite pillar and the amberite washer placed above it was sealed with paraffin wax in order to prevent any acid products of the

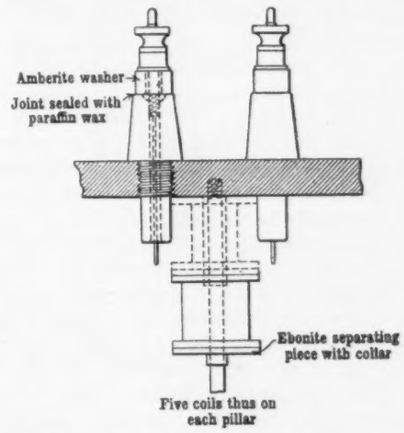


FIG. 3—GENERAL ARRANGEMENT OF TERMINALS AND COILS

exposed ebonite creeping between the two surfaces. The upper portion of the terminal screws is turned smooth to enable connection to be made at any point by means of an insulated split tube contact piece. The bobbins on which the coils are wound are of porcelain. Previous to winding, these were boiled in paraffin wax at a temperature of 150 deg. C. The wire used is constantan, No. 46, S. W. G.,

having a resistance of approximately 170 ohms per meter. From 7000 to 8000 turns are wound on each bobbin, the direction of the winding being reversed about ten times in order to reduce the self-inductance. The coils were boiled in paraffin wax for two hours at a temperature of 140 deg. C. After their resistance had been measured and roughly adjusted they were kept under observation for several months. During this period the change in resistance was generally not more than 2 parts in 10,000. The coils were then finally adjusted, copper ends were soldered on to the ends of the resistor wire, and after again being boiled in wax, final determinations of the resistance were made.—London *Electrician*, June 27, 1913.

Modification of the Carey Foster Method of Comparing Resistances.—FRANK WENNER.—An abstract of an American Physical Society paper. The method was developed for use in the measurement of the resistances of a number of similar conductors connected in series, such, for example, as the coils of a low-resistance potentiometer. In such measurements it is not possible to put a slide wire between the resistor being tested and the standard of resistance, so it is necessary to provide some other means of making and reading the small changes neccessary to balance the bridge. This is accomplished by using a variable-ratio coil set of the direct reading type instead of fixed-ratio coils such as are regularly used in Carey-Foster bridges. The ratio set used has a range of 1 per cent, and while designed for other work has been found to be very satisfactory for this

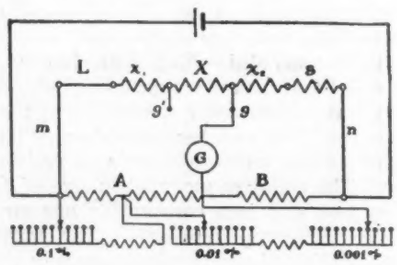


FIG. 4—CIRCUIT FOR COMPARING RESISTANCES

purpose. The method will be understood by reference to Fig. 4, in which X represents the conductor whose resistance is to be compared with that of the standard S, while L is a connecting link interchangeable with S. The conductors, x_1 and x_2, are permanently connected to X, m and n are connecting leads, A and B the two sides of the ratio set, and g and g' terminals of the conductor X. In general the same characters are used to represent the value of the resistances. The ratio of A to B may be represented by $1 + r + c$, where r is the reading and c the correction to the reading of the ratio set. The bridge is balanced first with the arrangement shown in the figure, then with the link and standard interchanged and the galvanometer connected at g'. From the two relations it follows that

$$2\,(X - S + L) = (r + c)\,(x_2 + S + n) - (r' + c)\,(X + x_2 + L + n)$$

where r' is the second reading of the ratio set. If the correction c is the same for both readings and $r + c$, $r' + c$, and L are all small in comparison with X and S, then $x_2 + S + n$ is very nearly equal to $X + x_2 + L + n$, and hence approximately

$$X = S - L + \frac{x_2 + S + n}{2}(r - r').$$

In case several similar conductors are being compared, x_1 and x_2 are of the same nominal value as X and S, while m and n are small, in comparison, and hence the latter equation may be put in the form

$$X = N\,(1 + c - 1 + r - r').$$

Where N is the nominal value of the resistances X and S, s the excess in proportional parts of the resistance of the standard above its nominal value, l the ratio of the resistance of the link to the resistance of the standard, and r and r' the two readings of the ratio set.—*Phys. Review*, June, 1913.

Self-Recording Electrometer.—J. PATTERSON.—Benndorf has designed an electrometer which gives a continuous record by mechanical registration, and a British company has a self-recording galvanometer on the same principle, called the thread-recorder. In the Benndorf instrument the apparatus for producing the registration is operated by an electromagnet worked by clockwork, while in the thread-recorder it is all done by clockwork. It occurred to the author that the recording mechanism of the thread-recorder could also be used for a self-recording electrometer as well as for a galvanometer. In these instruments a boom with a counterpoise is attached to the axis of the needle, and the excursions of the end of the boom are registered at stated intervals by a bar dropping and nipping an inked thread or ribbon between the boom and the recording paper, thus leaving a dot, which gives the deflexion of the needle at the moment of registration. In this way all mechanical friction is avoided. The construction of the electrometer is given in some detail together with the results of experiments. The advantages claimed for the instrument are simplicity of construction; little attention required when in working condition; high degree of sensibility enabling the potential of the air to be measured with a battery of only a few volts; and fair uniformity of scale over the range of the recording paper.—*Philos. Mag.*, July, 1913.

Miscellaneous

Resistance Welding.—OTTO FUCHS.—A profusely illustrated article giving the results of an investigation of the electric resistance welding of sheets. The primary and secondary current, the power and the temperature were measured and the strength of the welds were tested. Micro-photographs are given of the structure of the welds. Besides iron and steel the welding of other metals is also considered. It is important that the welding process should be done as quickly as possible. Electric welding seems to be more convenient and rapid than autogenous gas welding.—*Elek. und Masch.* (Vienna), June 8, 1913.

Book Review

THE PRACTICAL ELECTRICIAN'S POCKET BOOK FOR 1913. Edited by H. T. Crewe. London: S. Rentell & Company, Ltd. 440 pages and diary. Illus. Cloth, price, 1 shilling.

This useful little book contains information of a character even more extensive than might be guessed from an interpretation of its title in the American vernacular, for a number of its pages are devoted to central-station subjects, prime-mover apparatus, steam and internal-combustion engines, water-wheel equipment, switchboard construction, etc. Street-railway and telephone topics are also given attention, and there are chapters on repair methods, test schemes for locating faults in machines and wiring circuits, measurements, etc. Under the division of applications of electricity will be found a new chapter on the use of electric coal-cutting machines, and there are many pages descriptive of practical wiring methods, plans for direct and indirect illumination, operation of household appliances, construction of vacuum cleaners, control of circuits, wireless stations, Home Office mining rules, Board of Trade rules for electrical construction, etc. Tables of practical electrical reference data, reports of British central stations, instructions for resuscitation from electrical shock, and a number of blank memoranda pages complete the practical usefulness of this convenient and brief compilation.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Fuseless Rosettes

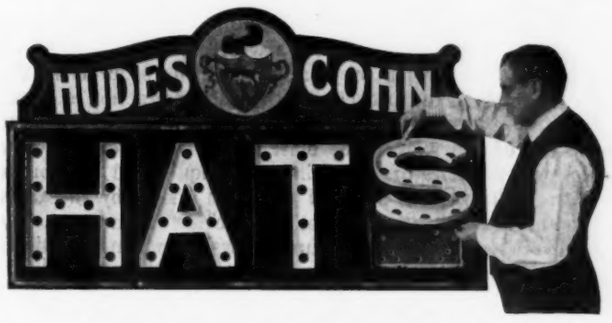
Two types of fuseless rosettes or outlet box covers recently placed upon the market by Pass & Seymour, Inc., of Solvay, N. Y., are illustrated herewith. The smaller of the

OUTLET BOX COVERS

two illustrations portrays the type of cover which is intended for use with 3-in and 3.25-in. outlet boxes, while the larger cover is made for use on 4-in. boxes. To facilitate handling the rosettes, which are of porcelain, are packed for shipment in pasteboard boxes containing the requisite number of screws for their installation.

Interchangeable Electric Sign

Electric signs which have come to be regarded as a potent factor in augmenting the central-station load are found in designs varying from the crude home-made affair to the massive steel structure which often weighs more than 20 tons. One of the most recent additions to this already widely varying category of advertising media is the interchangeable sign which is being put on the market by the A. & W. Electric Sign Company, of Cleveland, Ohio. This sign is built up of a number of separate panels each of which is equipped with a sufficient number of wired outlets to allow any letter of the alphabet to be placed upon it. When the letter is in position special receptacles furnished with the sign are pushed into place through the holes left for the purpose in the letter. With the single pair of outlet wires connected to the lighting circuit the sign is ready



ELECTRIC SIGN WITH INTERCHANGEABLE LETTERS

for operation as soon as the lamp receptacles are pushed home.

The body of the sign is constructed so that any number of letter panels may be used. The accompanying illustration shows a man in the act of placing a letter on a four-panel sign. The wired outlets which are to receive the lamp receptacles are shown below the tilted letter. The ornamental legend at the top of the sign which bears the name of the company is also detachable. It is stated that even a person with no knowledge of electric wiring can effect a change in a large theater sign in a remarkably short space of time.

Meter Testing Table

An electrical meter testing table at which eight men can be accommodated simultaneously with each man handling four meters has recently been installed for the Municipal Gas Company, of Albany, N. Y., by the H. W. Johns-Manville Company, Madison Avenue and Forty-first Street, New York City. The table is constructed of a fireproof product known as ebony asbestos wood and is arranged in two sections, the dimensions of which are 15 ft. long by 5 ft. 4 in. wide by 6 ft. high over all. The rack or upright board is 3 ft. in height and the shelf or table is 20 in. wide. The rack and the shelf are 1 in. thick, and the space be-

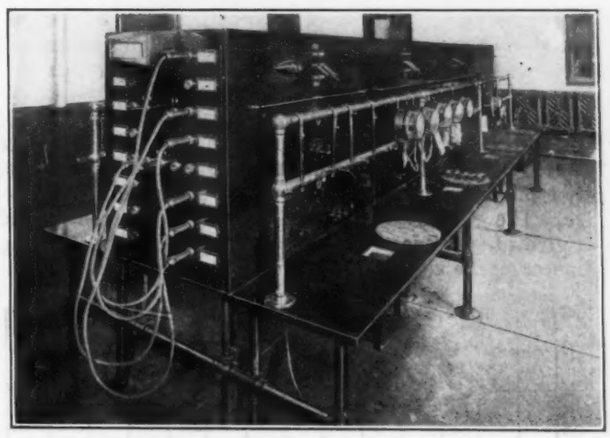


TABLE FOR TESTING ELECTRIC METERS

tween the racks at the top is covered with 0.25-in. asbestos wood.

Immediately in front of each tester are a set of binding posts, three load switches and a potential switch providing emfs from 110 volts to 220 volts. The wiring is arranged so that the power-factor of the test circuit can be varied from zero to 100 per cent by small steps and any load from zero to 800 amp can be obtained. The circuits for each tester's position are independent from those of any other so that if eight men are working at the table each may be using a different load from the others without interference with his co-workers. The plugging arrangement and ammeter shown at the end of the table are used in obtaining the approximate load desired. Where meters of different types are being tested either alternating current or direct current may be obtained at both sides of the table simultaneously, or the table may be divided with direct current on one side and alternating current on the other. The rotating standards are placed under the table and are read through an opening which has been cut in the bench for this purpose. The table is constructed so that additional units may be added from time to time without interfering with the original wiring.

Improved Primary Wet Cell

A liquid battery recently subjected to a series of tests under various conditions has given results well worthy of notice. This type of cell, which is a product of the Burns-Boston Battery & Manufacturing Company of Boston, Mass., purports to possess all of the good qualities of the dry battery and yet to be free from most of the bad features of the dry cell. The square moisture-proof case of this battery encloses a zinc shell which contains a balance of active elements, zinc, carbon, and salt solution. Except for a pin-hole vent, the cell is tightly sealed to avoid leakage. The electrolyte is a non-freezing liquid and is said to give off no fumes. To reduce the chance of a wrong connection the zinc terminal is made a flexible wire permanently soldered to the electrode while the carbon terminal is provided with a lock nut. A single cell measures 7.5 in. high by 2.6875 in. square, occupying the same space as a dry cell. These cells also give the same potential as a new dry cell, namely, 1.5 volts per cell.

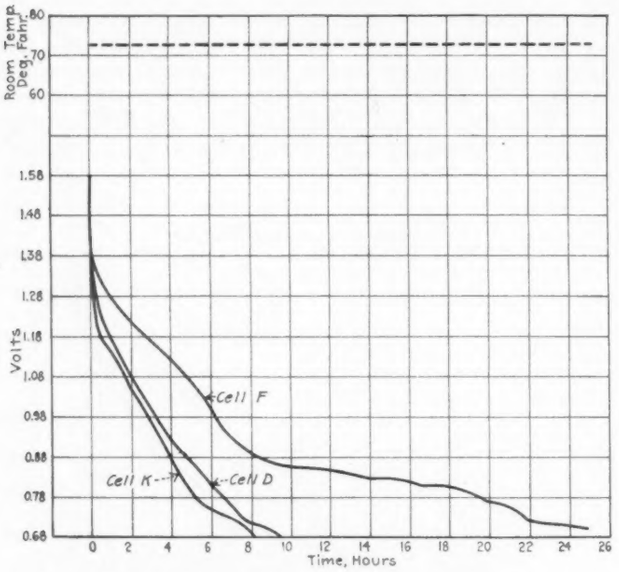


FIG. 1—CURVES SHOWING RESULTS OF CONTINUOUS DISCHARGE TEST AGAINST A RESISTANCE OF 1 OHM

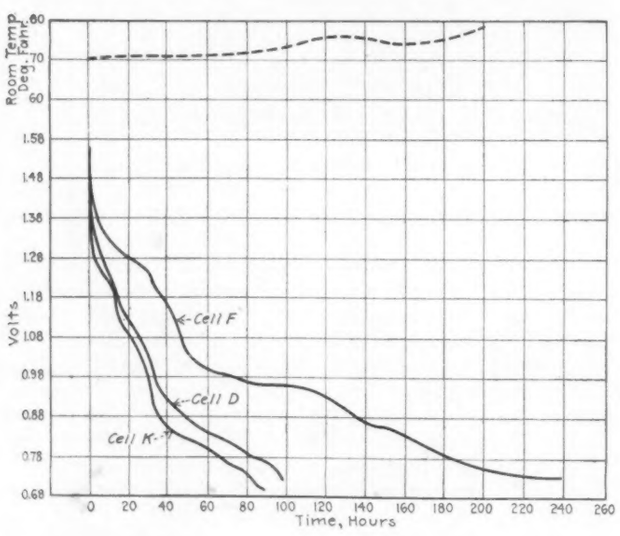


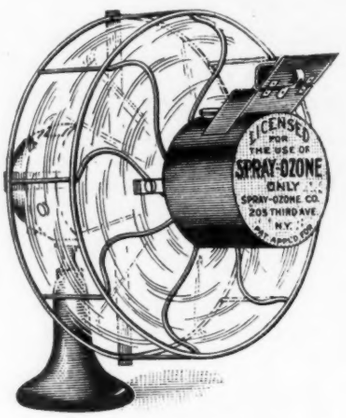
FIG. 2—CURVES SHOWING RESULTS OF CONTINUOUS DISCHARGE TEST AGAINST A RESISTANCE OF 5 OHMS

The United States war department made a comparative test on these liquid batteries and upon ten dry cells for shelf life (charged). After six months' storage at boiler-room temperature the wet cells showed no decrease in amperage whatever while the nearest competing dry cell when tested showed 40.4 per cent depreciation. This test shows that one of the worst defects of the dry cell, deterioration in storage, has been overcome by the new cell.

The accompanying curves which were prepared by the Electrical Testing Laboratories, New York City, show clearly the remarkable performance of these liquid cells upon continuous discharge test. Fig. 1 shows the result of a simultaneous continuous discharge test made through a resistance of 1 ohm upon one liquid battery (cell F) and two dry cells (cells K and D). This curve sheet shows that twenty-four hours were required to deplete the wet cell to the state which was reached by the dry cells in from eight hours to nine hours. A similar test of three cells of the same make as previously used against a resistance of 5 ohms showed practically the same proportion of advantage for the liquid battery. That is, the emf of the wet cell at the end of 240 hours continuous operation was 0.69 volt while cells C and D were reduced to a potential of 0.69 volt in 80 hours and 100 hours respectively.

Electric Fans Used for Disinfectant

A device which may be attached to any electric fan for the purpose of automatically disinfecting the room in which the fan is operating is now being manufactured by the Spray Ozone Company, Inc., of 205-211 Third Avenue, New York City. As is shown in the illustration the attachment consists of a brass container for the liquid disinfectant from which projects a wide mouthed spout. The lower end of a wick projecting from this spout is in the liquid; due to the process of capillary attraction a fresh quantity of the disinfectant is always found available at the top of the wick. The blast of the fan over the wick picks up particles of the disinfecting liquid and distributes them in the various parts of the room visited by the fan's air currents. It is said that this device is finding ready application in moving picture shows, department stores, hospitals, railway cars and many other public places.

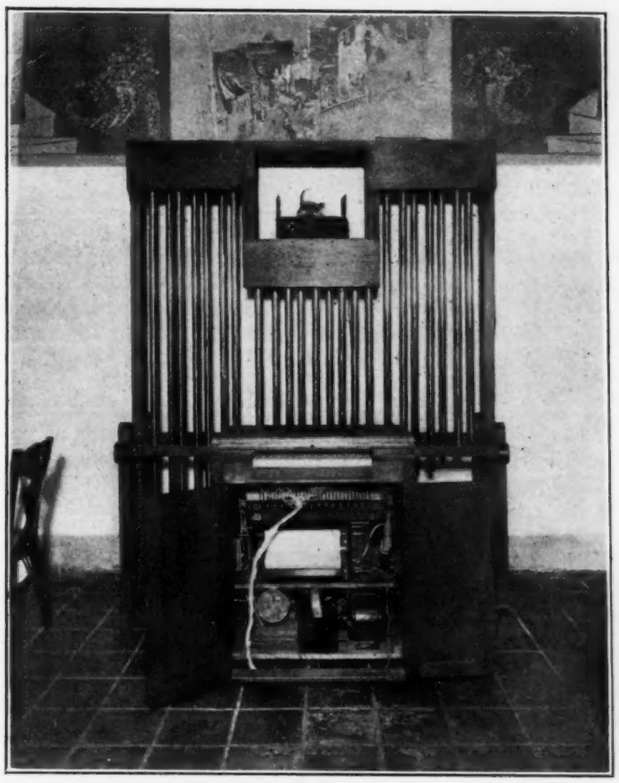


ATTACHMENT FOR ELECTRIC FAN

Electric Temple Bells and Chimes

Among the many unique and pleasing features which make the Woolworth Building more than a massive pile of architecture with a claim to interest only on account of its sheer size are the electrically operated bells and chimes found in the "rathskeller" of the building. The temple bell outfit consists of twenty resonator bells ranging in chromatic intervals from low C to high G. The bells are

mounted upon felt-covered oak disks, and each bell is fitted with a resonator which is bolted to the supporting frame of the bell. Upon the same wooden disk with each bell is mounted a direct-current magnet. The wires from the magnets are led through the piano keyboard, beneath which are arranged a number of contacts. By wiring these contact points in series with the source of energy and the bell, pressure on the keyboard completes the circuit and rings the bell corresponding to the note of the key depressed. For striking the twenty-three bell-metal chimes shown in the background of the illustration single-stroke direct-current magnets are used. As it is desirable at times to play either the bells or the chimes separately, a switch is provided making it possible to connect each into the circuit separately or to connect them so that bells and chimes can be played simultaneously.



ELECTRICALLY OPERATED CHIMES IN RATHSKELLER OF WOOLWORTH BUILDING

Ordinarily these bell and chime outfits are driven by a Geisgler storage battery, but the set in the Woolworth Building is equipped with a motor-driven pneumatic player attachment supplied with electrical energy from the direct-current lighting circuit. The automatic player is actuated by a clockwork mechanism which operates the chimes every half hour.

The entire bell and chime outfit was supplied by the Yerkes Sound-Effects Company, 202 East Eighty-eighth Street, New York City.

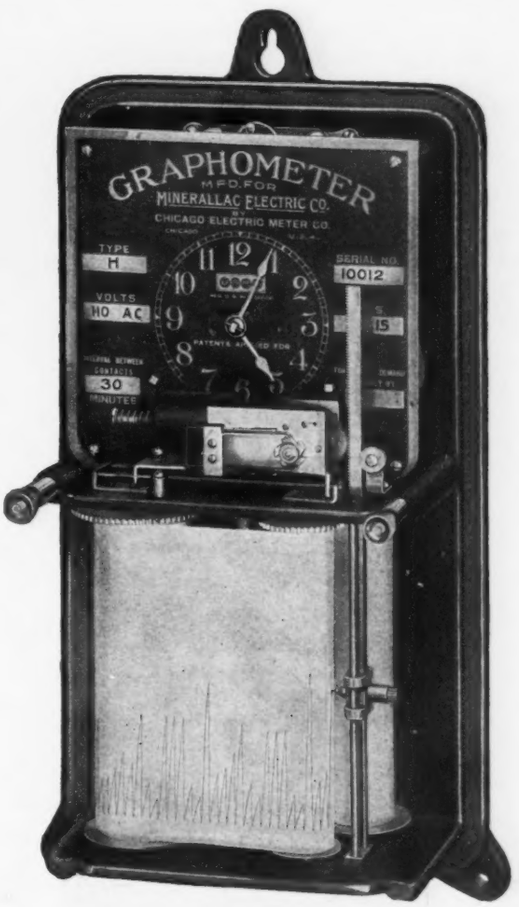
The Graphometer

The Chicago Electric Meter Company has developed a device, based upon inventions of Charles H. Merz, Simon B. Storer and others, that will give a record based like those of the printometer and maxicator, on the modern principle of measuring the demand, that is, the average demand during a definite time interval; but, instead of printing or indicating, this new instrument records the demand on a chart, so that it will be possible to see at a glance the maximum demand, the time it occurs and its relation to other load conditions during the month. This is the form of record obtained by the graphometer, the instrument which is illustrated herewith.

Other forms of graphical records are instantaneous and show extreme peaks and rapid variations of load. With instantaneous records it is necessary to apprroximate the average consumption for each interval and then use this average in figuring the bill. The graphometer gives this average automatically and draws the record ready for immediate use.

The graphometer is connected to the watt-hour meter by means of three small wires which lead to a contact-making device on the register of the watt-hour meter. This device closes the circuit on a solenoid connected to a rack carrying a stylus on the graphometer. Each operation of the solenoid moves the stylus forward on the graphometer.

This stylus while advancing is in contact with a treated paper chart, which is being driven forward at right angle to the stylus, at a definite speed, by means of a high-power clock contained within the graphometer. The stylus will, therefore, continue to be driven upward for each operation of the contact-making device on the watt-hour meter register, the height of this line representing kilowatt-hours, and the paper will move forward steadily at right angle thereto, the base line of this portion of the chart representing the time. Then at the end of the interval for which the demand is to be taken, say, for instance, thirty minutes—the carriage holding the solenoid will become disengaged from the rack carrying the stylus and will allow it to return to the bottom of the chart, or the zero position, where the same series of operations will begin for the next



DEVICE FOR GRAPHICALLY RECORDING MONTHLY DEMAND CHARTS

interval. The highest point reached on the chart by the stylus during the month will, therefore, be the maximum demand for the month and may be read directly in kilowatts. Since the total consumption is obtained from the watthour-meter dials, the combination of the graphometer with the watt-hour meter will give both the total consumption and maximum demand for the month and will show the time it occurs.

The graphometer is simple in construction. There is no pen-and-ink arrangement used, as it has been found that these attachments often give trouble. The solenoid which is used to advance the stylus may be operated from any one of the following sources: 100-volt alternating current, 220-volt alternating current, 18-volt direct current, 110-volt direct-current. The instrument can be set for demand intervals at five, ten, fifteen, twenty, thirty and sixty minutes.

The chart used with the graphometer are 6 in. wide and are advanced 0.25 in. per hour, so that a one week's record will be approximately 3.5 ft. long.

The graphometer may be applied to any watt-hour meter regardless of the make, type or capacity, permitting the use of the present watt-hour meters and also one type of maximum-demand device with any watt-hour meter on the sytem.

Records obtained with the graphometer must be accurate, since the device is electrically interlocked with the watt-hour meter and depends solely on the calibration of the watt-hour meter for its accuracy; and the time is also acccurate, since this element of the device is mechanically interlocked with a high-grade clock and differs from other curve-drawing devices in that the time is not dependent upon the speed of travel of the paper but only upon the length of time between each return of the stylus to the base line or zero point. This gives a definite time interval. The manufacturer says that the graphometer is protected by patents which are issued or are pending.

Illuminated Danger Sign

Following the general adoption of the "Safety first idea" by many railways, mining and power companies, the Electric Service Supplies Company of Chicago has placed on the market a new type of illuminated sign consisting of a steel frame joined at the top in the shape of a hood under which is placed a weatherproof socket and one incandescent lamp.

ELECTRICALLY LIGHTED WARNING SIGN

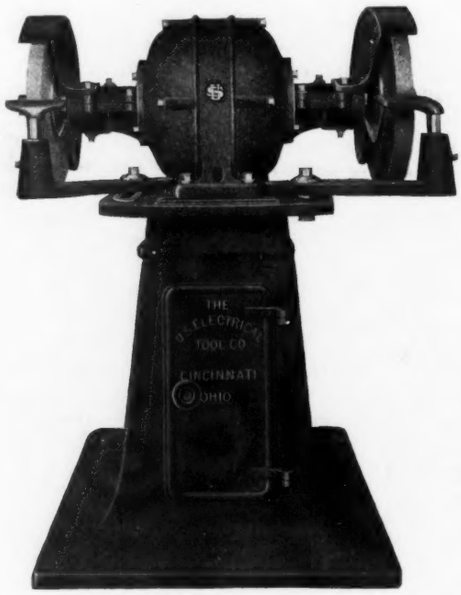
The hood is given a coat of aluminum paint on the inside and acts as a reflector as well as a protection to the lamp. Standard enamel steel signs are attached to this frame by means of six machine screws, the standard size of the sign proper being 10 in. by 12 in.

These signs may be made to read in several different languages, as the one shown herewith, which portrays the message in English, Italian, Lithuanian, Polish and Slavok. In mines where an illuminated sign is essential this type of warning is used extensively to warn the workman of the danger of gases, falling timbers and electric wires. For railway companies their use at stations and cross-overs to inform the public of possible danger is advantageous in view of the low cost of operation and maintenance.

Double-Disk Grinder Electrically Driven

Every step away from belt drive is in general a step toward increased economy, reliability and convenience, and, not least important, toward increased safety of operation of machines and machine tools. The lower first cost of the belt drive as compared to individual electric motor drive is, in the main, the only real argument in its favor, although there are undoubtedly occasional instances where it possesses other advantages. Not the least of the disadvantages of belt drive is the fact that it cuts off light and the extra cost of artificial illumination is often a considerable item.

In the accompanying cut is shown a front view of the new double-disk grinding and buffing machine recently put on the market by the United States Electrical Tool Company, of Cincinnati, Ohio, and designed to include the qualities of compactness, simplicity and efficiency. Westinghouse motors of 3 hp or 5 hp furnish the drive and are supplied for 110-220 volts, direct current, or 220-440 volts, alternating current, 25 or 60 cycles, two-phase or three-phase. The motor is totally inclosed and is equipped with an especially heavy shaft. Bearings are large and dust-proof, being ring-oiled and self-lubricating. No starting box is required.



DOUBLE-DISK GRINDER

One who has worked with the old belt-driven grinder, with its jerky, uneven and uncertain action, its slapping, irritating noise and its excessive bearing wear, will appreciate the improvements effected in the newer type above illustrated.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Cable Making Record.—During the week of June 9-16, the Hawthorne Cable Shops of the Western Electric Company turned out lead-covered cable containing 256,000,000 conductor feet of wire, or in the neighborhood of 48,500 miles, breaking all previous records for this plant.

Search-Lamp Sales.—Twenty-two electric search-lamps, varying in size from 7 in. to 24 in., have been shipped out during the past few weeks by the Carlisle & Finch Company, Cincinnati, Ohio. Of these, three were sent to Canada and the rest were scattered pretty well through the United States.

Electric Companies Buying Economizer Equipment.—At the present time electric lighting and traction companies are the heaviest buyers of economizer equipment, according to recent advices from the Green Fuel Economizer Company, of 90 West Street, New York. Large orders have lately been placed for this class of apparatus by the Philadelphia (Pa.) Traction Company and by the Alton Gas & Electric Company, of Alton, Ill.

Boot and Shoe Factory Installs Electric Drive.—The F. Mayer Boot & Shoe Company, of Milwaukee, Wis., has ordered from the Mechanical Appliance Company, of the same city, motor equipment for the new section of its plant. There will be supplied five 2 hp motors and nineteen 3 hp motors, all of the Watson slow speed type, operating on direct current at 220 volts. The motors will run at a speed of 420 rpm and will be directly connected to the sewing machine shafts.

Mercury Lamp Situation.—It is understood that the Cooper Hewitt Company, of Hoboken, N. J., is viewing present conditions in its lines with entire satisfaction. A large proportion of its sales are to manufacturing firms, and even at this early date there has been noticed a decided and well-distributed tendency to prepare lighting equipment for shorter days and overtime work. At the present time the company is enjoying, in addition to its regular business of supplying lamps for industrial lighting, a period of decided activity in sales of lamps for use by photographers.

Pushing Mexican Power Project.—The Mexican Northern Power Company is pushing work on its generating plant and transmission line at La Boquilla, Chihuahua, Mexico. Four Escher-Weiss water turbines, directly connected to 10,000-kw General Electric alternators, are to be installed in the generating station when completed, and the auxiliary apparatus at this station will all be of General Electric make. A 47-mile steel tower 110,000-volt transmission line will carry the energy to Parral, where it is to be used for operating mining machinery. At the step-down station at Parral the transformers are to be of General Electric make and the rest of the equipment will be supplied by the Westinghouse Electric & Manufacturing Company.

Refrigerating Machines Going Fast.—Cheerful reading for the recent hot weather is furnished by the report of the York Manufacturing Company, York, Pa., on the sales of refrigerating machines between May 21 and June 23. Eighty-eight machines were disposed of with an aggregate output rating of 1641 tons, and these were placed all over the United States and adjoining territory. The largest installation was for Standard-Waygood, Ltd., Sydney, Australia, consisting of three 90-ton units, arranged for electric motor drive, to be used in the municipal market at that place. Other large buyers were Conron Brothers Company, of New York, 150-ton machine, and J. M. Horton Ice Cream Company, also of New York, 125-ton machine. Among the installations outside the United States were two for the E. Weise Company, in Alaska, three for Agar Cross & Company, in Buenos Aires, Argentine Republic, one for Mora & Majo, in Santiago de Cuba, and one for James M. Motley, in San Pedro, Honduras. Three machines went to Canada, all of them for the Province of Ontario. In addition to the above-mentioned machines there was sold a large amount of auxiliary equipment for ice-making and cold-storage systems.

Nordberg Hoisting Installation.—An order has just been placed by the Inspiration Copper Company for two double-drum mine hoists, to be built by the Nordberg Manufacturing Company, of Milwaukee, Wis. Each hoist will be designed to lift 18 tons (exclusive of the cable) from the present working depth of 650 ft. at an operating speed of 750 ft. per minute. The two drums on each hoist will have a diameter of 10 ft. and a face of 65 in., grooved for 1000 ft. of 1¾ in. rope. The braking and control mechanism is of special design. A normal hoisting rate of 30 trips per hour is anticipated, enabling each hoist to handle about 5000 tons of ore in a 14-hour day. General Electric direct current motors will be used to drive the hoists and the installation will include an Ilgner motor-generator set.

Sign Company Selling Plan.—The A. & W. Electric Sign Company has recently announced that it is about to put into effect a selling plan which it is thought will be of value to the central stations in securing electric sign business. According to the proposed scheme the interchangeable electric signs manufactured by the above company will be sold to the central stations with the understanding that the station salesmen shall resell them to customers on a thirty-six monthly-payment plan. In case the company receiving the sign fails to make all of the payments, or for some reason wishes to discontinue the service, the central station will be permitted to return the sign to the A. & W. Electric Sign Company and will be credited with the cost price of the sign less one thirty-sixth of the cost price for each month that the sign has been in service. In view of the interchangeable feature of the sign few redemptions are anticipated by the sign company.

Boiler Sales Still Active.—In spite of a pretty general slowing up of business, reflecting a combination of the usual summer dullness and the present tight money market, the sales of boiler equipment reported by the Babcock & Wilcox Company, of 85 Liberty Street, New York, show that their product is enjoying a wide demand. Public utility companies have been the largest buyers of boilers and auxiliary equipment, aggregating in the neighborhood of 13,700 hp, since the last report was received, but industrial companies with a total of 11,200 hp, bought during the same period, are not far behind. The larger purchasers among utility companies were the Public Service Company of Northern Illinois, Blue Island, Ill., with 3048 hp, and the Public Service Electric Company, of Marion, N. J., with 3000 hp. Of the industrial concerns the Toledo Furnace Company, of Toledo, Ohio, with 4137 hp, and the National Biscuit Company, of New York, with 2080 hp, were the heaviest buyers of boiler equipment.

Southern Hydroelectric Developments.—H. A. Lewis, manager of the New York office of the Hot Point Electric Heating Company, 46 West Street, who has just recently returned from a trip through the South, states that progress is being made in hydroelectric development work in that section of the country, especially in Tennessee, Georgia and Alabama, and that a number of the smaller stations in each location are being tied together in a large unified system. Speaking of the outlook for the company he represents, Mr. Lewis says that the report printed in the June 21 issue of the *Electrical World*, to the effect that the main office of the company is to be moved from the Pacific Coast to Chicago, was in error, the only change at the

latter place being an extension of the factory. The business of the company in this country has been satisfactory recently, and the export business has been particularly pleasing, large numbers of heating appliances being shipped to England, France, South America, Australia and New Zealand.

Old Firm Incorporates.—The firm of Charles Cory & Son, of 286 Spring Street, New York, which has been controlled by the Cory family for the past seventy-five years, has recently been incorporated, ownership and management being retained by Messrs. Charles and John M. Cory. No change will be made in the company's office and factory address, which continues as above indicated. This company specializes in electric and mechanical signaling and communicating equipment for war vessels and supplies all this sort of equipment for the ships of the United States Navy. At the present time installations of this nature are being made in the battleships *New York, Texas, Pennsylvania, Oklahoma* and *Nevada,* the gunboat *Sacramento* and in a number of destroyers now under construction in the several navy yards. As no two battleships are built exactly alike, and as the changes in design of this class of vessels are extremely rapid, the design of signaling and communicating equipment for each ship is almost a distinct problem. This is probably one of the most highly specialized branches of the electrical industry.

Proposed Extensions to Municipal Plant in Jamestown, N. Y.—The Board of Electric Lighting Commissioners of Jamestown, N. Y., has recommended to the Common Council of that city that bonds of the city to the amount of $40,000 be issued, if approved at a taxpayers' election. The proceeds of these bonds are to be used to extend the municipal electric-light plant. The commissioners declare that the surplus earnings of the plant, together with the moneys raised by the Common Council for street-lighting purposes and all other moneys on hand, are insufficient to meet the cost of the desired extensions and improvements. It is desired to purchase 1000-kw turbo-generator to cost about $21,000; two 75-light street-lighting sets and 150 luminous-arc lamps to cost about $7000; three mechanical stokers and the rehabilitation of the old blower system, to cost about $4000; a new street-lighting circuit to cost about $2000; a new storage building and repair shop to cost about $5500, and incidentals, $500. The output of the 1000-kw unit is desired for additional commercial service. Mr. Clement B. Jones is secretary of the Board of Electric Lighting Commissioners.

Electrical Energy for Large Chicago Tannery.—Along with the construction of its new eight-story tannery, which measures 240 ft. by 130 ft. on the ground floor, the Griess-Pfleger Tanning Company, Chicago, is building an electrical plant which will generate all of the energy which is used in the building. One 150-kw and two 500-kw Westinghouse 440-volt, three-phase alternating-current generators driven by reciprocating steam engines are being installed in a separate building near the tannery proper. Each generator carries its individual exciter mounted on the same shaft. A twelve-panel switchboard measuring about 7.5 ft. high from the floor is to be installed by Kohler Brothers of Chicago. The motor-feeder panels on this board are asserted to be the largest ever made and are constructed by the States Electric Company, Chicago. Energy for the operation of the motors used in this tannery will be supplied at 440 volts, while that for lighting will be stepped down to 110 volts, three-phase, at the switchboard. Lead cables will be run from the switchboard to a junction box in the tannery, from which double-braided cables will be run to various cutout cabinets throughout the building. Wiring of tanneries is somewhat different from that in other buildings because acid fumes have to be contended with after the work is completed. To safeguard against the fumes special conduit manufactured by the Safety Armorite Conduit Company has been used throughout the building. All of the conduit is run exposed so that additional motors can be installed at the most convenient points after the building is completed without having to run feeders a long distance to some motor outlet. The motors range in size from 5 hp to 50 hp, most of them being installed on the ceilings. There will be about 1300 hp in motors installed in the building for drying, pressing, dipping, etc. Outlets capable of supplying twelve lamps each are installed in the building, and at present about 1000 lamps will be connected. If the labor trouble in Chicago is settled soon, it is expected that the entire electrical equipment will be ready for operation by the latter part of August. The entire wiring contract is held by the Freeman-Sweet Company, Chicago.

Northern Illinois Company Sells Short-Term Notes.—The Public Service Company of Northern Illinois announces the sale of $2,500,000 worth of three-year 6 per cent gold notes secured by $3,125,000 of the company's 5 per cent bonds. A syndicate composed of Lee, Higginson & Co., N. W. Halsey & Co. and Russell, Brewster & Co. purchased the notes, and it is said that the issue will be offered to investors on a basis to yield a 7 per cent return. Out of the proceeds the company will redeem the $1,500,000 note due on Oct. 3 and given in part payment for the Northwestern Gas Company.

Proposed Electric Bus Service in New York City.—During the past week or ten days there has come to light an interesting situation in the electric vehicle field which is worthy of close attention, both on account of the actual present importance of the movement and because of the latent possibilities for future development opened up by it. Four concerns have appealed to the Board of Estimate and Apportionment for franchises to operate bus lines in the city streets, namely: the Fifth Avenue Coach Company, the New York Motor Bus Company, the Manhattan Motor Bus Company, and the People's Five Cent Bus Line. The first-named line has been in operation for some time, and until last winter was in virtual control of the situation in New York City, but at that time the Legislature passed some measures which destroyed this monopoly. The company is now trying to strengthen its position by adding new routes to those already in operation under its earlier franchise. Of the two next mentioned companies there is not a great deal known at present, but it is suspected that one of them at least is aiming to secure routes which will take some of the traffic now controlled by the Interborough and New York Railways companies. The People's Five Cent Bus Line, which is controlled by George W. Loft and a half dozen or more prominent bankers, proposes to inaugurate a novelty in this class of service by charging, as the name implies, only a nickel a ride in place of the ten-cent fare long exacted by the Fifth Avenue Coach Company. About twenty routes have been laid out and applied for by the People's Line and these seem to be so placed as to give service in sections of the city which have long been difficult of access by the regular street-car lines. At present transportation facilities are notably poor in both the lower east and west sides, and especially along the water fronts, and routes have been requested by the People's company to cover these sections. Central Park has always been an effective barrier to traffic across town, there being only a single line, namely the Eighty-sixth Street Cross-town car, connecting the east and west sides of the Park. It is proposed to run two or three bus lines across the Park and one line up through it, if the necessary franchises can be obtained, and the People's Line, which is also applying for these routes, claims that by the use of electric drive the offensive noises and odors common to the gasoline cars can be eliminated and the main objections to bus service in the Park removed. The same company is also trying to obtain routes down through the business and financial sections and through the residential sections well uptown. If it succeeds in securing any of the franchises sought this company will probably put in service a fleet of single-deck storage battery cars of the four-motor four-wheel-drive type which has been used with some success in trucking service in Philadelphia and elsewhere. The patents covering this type of car are owned by the Imperial Electric Motor Company, a German concern, and the American rights are controlled by the Electro-Coach Corporation, of New York. These trucks are made at the plant of the Commercial Truck Company, in Philadelphia, Pa. An economic if not an engineering point in connection with the proposed service on the People's Five Cent Line is the plan, said to be under consideration, for the use of lady conductors to collect fares and manipulate the bell on its electric busses.

Public Service Company of Oklahoma.—The Public Service Company of Oklahoma has been organized as a state company subsidiary to the Middle West Utilities Company of Chicago. The operating headquarters of the new company will be in Oklahoma City and it will control properties in Guthrie, Tulsa, Colgate, Vinita, Lehigh and Utoka.

Industrial Securities

Security	Capital Stock Listed	DIVIDEND		QUOTATION	
		Per Cent	Period	July 9	July 16
Allis-Chalmers, t.r., 5th pd	$19,800,000	.....	.....	5⅜	5⅞
Allis-Chal., pf.,t.r.,5th pd..	16,050,000	.....	.....	14*	14⅛
Amalgamated Copper.....	153,887,900	1½	Q	63⅜	66⅛
American Tel. & Tel.....	344,471,400	2	Q	126⅜	127¼
Electric Storage Battery,c.	16,074,425	1	Q	45½	46⅜
General Electric.....	101,363,600	2	Q	137	139½
Mackay Cos., c.....	41,380,400	1½	Q	89*	77⅓
Mackay Cos., pf.....	50,000,000	1	Q	68*	68
Western Union Tel.....	99,747,600	¾	Q	60	61½
Westinghouse, E. & M., c.	34,496,400	1	Q	57	59
Westinghouse, E. & M., pf.	3,998,700	1¼	Q	109*	109

*Last price quoted.

NEW YORK METAL MARKET PRICES

	July 8		July 15	
	Bid.	Asked.	Bid.	Asked.
Copper:				
Standard, spot*	13.75	to 14.30	13.25	.....
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard, spot*	63 3 9		62 8 9	
Prime Lake	14.75	to 14.85	14.50	.....
Electrolytic	14.50	to 14.60	14.15	to 14.25
Casting	14.35	to 14.40	14.05	to 14.15
Copper wire base	....	15.75	15.50	.....
Lead		4.35		4.35
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f. o. b. smelter		7.00		7.00
Spelter, spot	5.40	to 5.50	5.30	to 5.35
Tin, spot*	39.20	to 39.50	39.70	to 40.00
Aluminum:				
Prompt delivery	23.00	to 24.00	23.00	to 23.50
Future	22.00	to 23.00	21.00	to 22.00

*OLD METALS

Heavy copper and wire	13.25	13.25
Brass, heavy	8.12½	8.12½
Brass, light	7.25	7.25
Lead, heavy	4.25	4.25
Zinc, scrap	4.37½	4.37½

*COPPER EXPORTS

Total tons to July 15 10,000

*From daily market report of the New York Metal Exchange.

Business Notes

Massachusetts Chemical Company.—The Boston office of the Massachusetts Chemical Company has been moved from 185 Summer Street to 757 Boylston Street.

The Bryant Electric Company and the Perkins Electric Switch Manufacturing Company, Bridgeport, Conn., have opened New York sales offices in the Vanderbilt Avenue Building, 51 East Forty-second Street, in charge of Messrs. Frank Stout and Robert Abbott.

The Electric Controller & Manufacturing Company.—Mr. W. H. Williams, formerly in the Pittsburgh office of the Electric Controller & Manufacturing Company, has been made district manager for the company in the Chicago territory.

The Line Material Company, of South Milwaukee, Wis., maker of insulator brackets, outdoor lighting brackets and other line construction material, have established offices at 114 Liberty Street, New York; 229 Sherlock Building, Portland, Ore., and 915 Olive Street, St. Louis, Mo.

The Arrow Electric Company, Hartford, Conn., manufacturers of sockets, switches and electrical supplies, held a sales conference, July 15 to 17, which was attended by about twenty of its salesmen from all parts of the United States and Canada. Business sessions occupied a part of each day, the balance being given over to various forms of amusement and entertainment provided by the company.

New Industrial Companies

The Farkas Lamp & Wire Company, of Hoboken, N. J., has been incorporated with a capital stock of $125,000 to manufacture incandescent lamps, etc. The incorporators are: M. H. Breen, W. H. McTigue and D. Lubash, of Hoboken, N. J.

The Hammesfahr Glass & Insulation Company, of Brooklyn, N. Y., has been incorporated by H. Hammesfahr, E. Hammesfahr and H. Hammesfahr, Jr., of Brooklyn. The company is capitalized at $100,000 and proposes to manufacture and deal in insulation.

The Electric Specialty Company, of Baltimore, Md., has been incorporated by Julius H. Wyman, Fidelity Building, Baltimore, Md.; John M. Wright, of Baltimore, and William M. Pyle, of Wilmington, Del. The company is capitalized at $10,000 and proposes to manufacture electrical machinery.

Trade Publications

Wire.—The American Electrical Works, Phillipsdale, R. I., has recently distributed a price list of wires and cables.

Direct Current Motors.—Bulletin No. A4121, of the General Electric Company, is a revision of the company's bulletin on direct current motors of the commutating-pole design.

Refillable Fuses.—A cardboard poster, 7 in. by 11 in., is being mailed by the A. F. Daum Company, Pittsburgh, Pa., showing cross-sectional views of refillable fuses for electric circuits.

Lamps.—A new price list, effective July 1, on Eastern tungsten lamps is being sent out by the Eastern Electric Lamp Co., Division of the Franklin Elec. Mfg. Co., Hartford, Conn.

Chandeliers.—Illustrations of some of the new designs added recently to its line of chandeliers have been published in leaflet form by the Beardslee Chandelier Mfg. Co. for inclusion with its loose-leaf literature.

Time Switches.—Various types of time switches, transformers for tungsten lamps, spot-lamps, search-lamps and other specialties are briefly referred to and illustrated in a leaflet issued by the Campbell Electric Co., Lynn, Mass.

Switches.—"Diamond H" push button switches, rotary-flush and rotary-surface switches, remote-control switches, automatic door switches, flush receptacles, steel wall cases and ground clamps are described and illustrated in Catalog E recently issued by the Hart Mfg. Co., Hartford, Conn. A number of wiring diagrams are included.

Feeder Voltage Regulators.—The General Electric Company has issued Bulletin No. A4129, which illustrates and describes in detail small feeder regulators. This regulator is of the pole type and is built for use on single-phase feeders only. It is made in two designs, one for outdoor installation and automatically operated, and the other for hand operation, and to be installed indoors only. The bulletin contains internal and external views and connection and dimension diagrams.

"Buckeye-Mobile."—The Buckeye Engine Co., Salem, Ohio, in its Bulletin No. 10-B gives detailed information in regard to its "Buckeye-Mobile." This apparatus is a complete self-contained superheated steam power plant composed of internally fired boiler, tandem compound engine, superheater, reheater, feed-water heater and pump, with or without condenser, for belted service or with flexible coupling for direct connection to generator. Some useful test data are given. The bulletin is fully illustrated.

Insulators.—A revised and enlarged edition of "The Insulator Book" has recently been published by the Locke Insulator Manufacturing Co., Victor, N. Y. The "Notes" which form the opening pages are full of interest and value, telling just the things that the prospective user of insulator would like to know. The many types of insulators and some special applications are graphically shown. The book is arranged in the modern "loose-leaf" form, making it possible always to keep the book up to date.

Personal Mention

Mr. Joseph S. Lovering has resigned as president of the Easton Consolidated Electric Company of Easton, Pa.

Mr. W. R. Tasker has succeeded Mr. F. S. Freemole as superintendent of the city lighting plant at Tecumseh, Neb.

Mr. A. T. McDonald has resigned his position as general sales manager of the Louisville (Ky.) Lighting Company.

Mr. S. G. Reque has recently been made general superintendent of the Northumberland County Gas & Electric Co., Sunbury, Pa.

Mr. F. H. Miller, of Toledo, Ohio, has become local manager of the Lebanon, Ind. plant of the Interstate Public Service Company.

Mr. G. A. Forgnier, formerly of Racine, Wis., has become associated as superintendent with the lighting and water system of Gladstone, Mich.

Mr. E. J. Nally, vice-president of the Postal Telegraph Company, returned this week from a vacation trip to Europe, his time abroad having been spent largely in London.

Mr. Alex Macauley, superintendent of the electrical department of the Beverly (Mass.) Gas & Electric Company, is this month celebrating the twenty-fifth anniversary of his service with the company.

Mr. R. P. Stevens has been elected president of the Eastern Consolidated Electric Company which has been taken over by the Lehigh Valley Transit Company of which Mr. Stevens is also president.

Mr. W. H. Blood, Jr., of Stone & Webster, Boston, Mass., and insurance expert for the National Electric Light Association, has sailed for Europe, where he will spend a vacation touring with his family in an automobile.

Mr. S. F. Messer, formerly with the Warren Water & Light Company and the Trumbull Public Service Company, both of Warren, Ohio, is now superintendent of the Kent Water, Light & Power Company, having succeeded Mr. A. B. Young, deceased.

Mr. F. A. Tennant has resigned as Assistant Commissioner of Patents to enter the practice of patent law at Boston. Mr. Tennant entered the United States Patent Office in 1895 and after a number of promotions was made Assistant Commissioner in 1909.

Mr. Howard Maxwell, formerly connected with the engineering department of the General Electric Company, has been appointed superintendent of the motor department as successor to Mr. J. A. Smith, who has been appointed general superintendent of the works.

Prof. Henry H. Norris has resigned his position as head of the electrical engineering department at Cornell University and will devote a part of his time to editorial work on this paper. He will have the title of associate editor and at present will make his headquarters at Ithaca, N. Y.

Mr. Zenas W. Carter, secretary of the Electric Development Association, Boston, Mass., sailed for Europe on July 13 from Montreal on the steamer "Ionian" of the Allan Line. He was accompanied by Mrs. Carter. They expect to spend about two months in England, France, Belgium and Scotland.

Mr. M. J. Curran, who succeeds Mr. Waldemar Michaelsen as city electrician of Omaha, Neb., was formerly connected with the Omaha Electric Light & Power Company, resigning after eight years' service to become superintendent of the Standard Electric Company. Since 1909 Mr. Curran has conducted an electrical contracting business in Omaha.

Mr. J. Martin, who has been associated with the United States Navy in electrical work for the past twenty years has joined the staff of the Marconi Wireless Telegraph Company of America. His first duties will involve the completion of a chain of 50-kw stations at New Orleans, Swan Island and Santa Marta for the service of the United Fruit Company.

Mr. Waldemar Michaelsen, for ten years city electrician of Omaha, Neb., has been succeeded in that position by Mr. M. J. Curran. Mr. Michaelsen served the city under three mayoralty administrations. He is a past-president of the Western Society of Electrical Inspectors, and is well known among electrical men of the west as an engaging speaker and humorist.

Mr. James A. Smith has been appointed general superintendent of the Schenectady works of the General Electric Company. Mr. Smith was formerly superintendent of the motor department and his present post has been newly created in order to relieve Mr. G. E. Emmons, who has been placed in general executive charge of all manufacturing operations of the company.

Mr. W. J. Canada, engineer of the Rocky Mountain Fire Underwriters' Association, has resigned to become associate physicist with the Bureau of Standards, Department of Commerce, Washington, D. C., where he will take up an investigation of the electrical life hazard, of which he has made a special study. Mr. Canada is past-president of the Western Association of Electrical Inspectors.

Gen. George H. Harries, president of the American Electric Railway Association, and an officer of several public utility properties controlled by H. M. Byllesby & Company, has been elected president of the Louisville Gas & Electric Company, chartered in Kentucky as a consolidation of the Louisville (Ky.) Gas Company and four other utility companies. Mr. H. H. Byllesby is chairman of the board of the new company.

Mr. Francis C. Pratt, who was assistant to Mr. E. W. Rice, Jr., when he was vice-president of the General Electric Company, has been appointed assistant to the president, so that Mr. Rice will not be deprived of his services. Mr. Pratt has also been placed in executive charge of engineering. He has been with the General Electric Company about eight years, coming to Schenectady from the Pratt & Whitney Company of Hartford. Mr. Pratt is a graduate from the Sheffield Scientific School, Yale University.

Mr. William T. Taylor, consulting engineer, Santiago, Chile, is visiting the United States in the interest of certain hydroelectric undertakings in South America. Mr. Taylor served for a time as general superintendent of the Jhelum Power Installation, Baramulla Kashmir, India, and later was associated with the Central Mexico Light & Power Company, San Luis Potosi, Mexico. More recently he has been president of Taylor & Company, Sao Paulo, Brazil. He is a member of the (British) Institution of Electrical Engineers and a fellow of the American Institute of Electrical Engineers.

Mr. George E. Emmons, for many years general manager of the Schenectady works of the General Electric Company, has been placed in general executive charge of all manufacturing operations of the company. Mr. Emmons has been with the General Electric Company for twenty-eight years. He entered the employ of the Thomson-Houston Company as cost clerk and served through various grades and positions until in 1895, one year after going to Schenectady, he was made general manager of the combined works. The new position is one of the highest in the gift of the company and has been won by a long record of successful achievements.

Obituary

Burton E. Baker, inventor and manufacturer of X-ray apparatus, died at his home at Hartford, Conn., July 10, of a malady superinduced by his continuous exposure to X-rays in connection with his work. A number of prominent physicians operated upon Mr. Baker in an attempt to stay the disease, but without result. He was 43 years of age, and was head of the Baker Electric Company and the Baker X-ray Tube Company of Hartford.

R. M. Ferris, chief engineer of the New York Telephone Company, was drowned July 13 while bathing at Siasconsett Beach, Nantucket, Mass. Mr. Ferris was 38 years of age and had served the telephone company for 15 years. He was a graduate of the Massachusetts Institute of Technology and the Riverview Military Academy. His home was at Montclair, N. J. Mr. Ferris was an associate member of the American Institute of Electrical Engineers.

Construction

New England

FORT KENT, MAINE.—A new electric-light plant is being built in Fort Kent, plans for which were prepared by Green & Wilson. Harry F. Green, of Waterville, has charge of the work.

NEWPORT, N. H.—The Public Service Commission has approved of an issue of $35,000 in capital stock by the Newport El. Lt. Co.

MORRISVILLE, VT.—A new 1000-hp James Leffel waterwheel has been installed at the Cadys Falls plant of the Morrisville municipal lighting and water plant.

BOSTON, MASS.—Bids will be received by the Schoolhouse Commissioners of the city of Boston, 120 Boylston Street, Boston, until July 22, for installing vacuum cleaning system in the Practical Arts High School, Greenville and Winthrop Streets, Boston, Mass. Charles Logue, John F. Kennedy and Charles B. Perkins are commissioners.

FITCHBURG, MASS.—Additions to the power station of the Fitchburg Gas & Elec. Co., to accommodate ultimately three 2500-kw turbines will be made within a short time. The equipment has been contracted for. C. R. Hayes, manager.

HOLYOKE, MASS.—The Holyoke St. Ry. Co. is reported to be preparing plans for improvements to its power plant. Louis D. Pellissier is general manager.

MILFORD, MASS.—The Milford El. Lt. & Pwr. Co., it is reported, contemplates extensions and improvements to its gas and electric systems to cost about $22,000. About $9,000 will be expended for improvements to the electric service.

TURNERS FALLS, MASS.—The Franklin El. Lt. Co. expects to purchase within the next three months additional street-lighting equipment. The company has recently closed a 10-year street-lighting contract with an increase in the number of street lamps. M. H. Mahoney is superintendent.

WESTFIELD, MASS.—The municipal light board is considering the proposition submitted by the Amherst Pwr. Co. of Greenfield, offering to furnish electricity to operate the municipal electric-light system. In case the department should decide to secure energy from the Amherst company an appropriation of from $10,000 to $15,000 will be asked for the erection of transmission line, transformers, etc. The transmission line will be extended from the West Springfield line, a distance of about 3 miles.

WEST SPRINGFIELD, MASS.—The City Council has given permission to the Amherst Pwr. Co. to erect a transmission line across the land to Bear Hole. This is considered the initial step in the plan of the board to use electric energy at Bear Hole in place of using energy derived from a gas engine, but it is planned to retain the latter for an emergency.

Middle Atlantic

ALBANY, N. Y.—Bids will be received by Duncan W. Peck, superintendent of public works, Capitol, Albany, until Aug. 5 as follows: Contract No. 93, Erie Canal, sections 5, 6 and 7; Oswego Canal, section 1—Power plants, electrical equipment and machinery for operating and lighting locks as follows: Erie Canal, locks 20, 21, 22, 23, 25 and junction lock at New London; Oswego Canal, locks 3, 5 and 6. Sheets 1 to 33 inclusive. Plans may be seen and detailed specifications, engineer's estimate of quantities, proposal blanks, form of contract and bonds required and other information for bidders may be obtained at the office of the superintendent of public works at Albany; at the office of the assistant superintendent of public works for the middle division at Syracuse; at the office of the assistant superintendent of the western division at Rochester, and at the canal office, Spaulding's Exchange, Buffalo. Copies of detailed plans or drawings may be obtained from the state engineer and surveyor at Albany, upon payment to him of the cost of producing same.

BROOKLYN, N. Y.—Bids will be received by the Department of Public Charities, foot of East Twenty-sixth Street, New York, until July 23, for furnishing material and labor necessary to reset 12 horizontal tubular boilers in the power house of the Kings County Hospital, Borough of Brooklyn. Blank forms and further information may be obtained at the office of the chief engineer of the department, foot of East Twenty-sixth Street, where plans and specifications may be seen. Michael J. Drummond is commissioner.

FULTON, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 14 for construction, complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Fulton. Drawings and specifications may be obtained from the above office or from the custodian of site at Fulton. O. Wenderoth is supervising architect.

JAMESTOWN, N. Y.—The Niagara & Lake Erie Pwr. Co., of Buffalo, is planning to extend its transmission line from Portland to Mayville and thence to Jamestown. The company has applied to the Public Service Commission for permission to issue $50,000 in bonds for the erection of a line from Portland to Mayville.

JAMESTOWN, N. Y.—Bids will be received by the Board of Electric Lighting Commissioners of Jamestown, until July 30, for furnishing one and two 75-lamp series luminous or flaming arc rectifiers sets and also 75 and 150 series luminous or flaming arc lamps in accordance with specifications on file at the office of the board. Specifications may be obtained at the office of the Board of Lighting Commissioners, City Hall, Jamestown.

LANCASTER, N. Y.—The Depew & Lancaster Lt., Pwr. & Conduit Co., of Lancaster, expects to install within the next three months three 200-kw transformers for 11,000-volt primary, 2200-volt secondary, 25 cycles; it also expects to purchase one 11,000-volt, three-phase, 25-cycle oil breaker; poles, wire, cross-arms and hardware for approximately 5 miles of arc lamp and low-tension wires; incandescent-lamp regulators for street service with reflectors, etc., within the next three months. A. R. Tremaine is superintendent.

LESTERSHIRE, N. Y.—The Board of Trustees is considering the installation of an ornamental street-lighting system in Lestershire.

NORWOOD, N. Y.—The Norwood El. Lt. & Pwr. Co. expects in the near future to install a water wheel governor, build a new concrete flume (500 ft. long), enlarge its raceway and change the position of the 350-hp engine. The cost of proposed improvements is estimated at $15,000. C. F. Vance is superintendent.

NUNDA, N. Y.—The Nunda Casket Co. expects to purchase within the next four months one 125-hp boiler, one 150-hp Corliss engine and two generators for its electric-light plant.

ONEONTA, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 21, for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Oneonta, N. Y. Drawings and specifications may be obtained from the custodian of site at Oneonta or at the above office. O. Wenderoth is supervising architect.

OWEGO, N. Y.—The Owego Lt. & Pwr. Co. expects to purchase within the next month one 150-hp water turbine. The company installed last year two 300-kva De Laval steam turbines, new condensers, pumps, oiler, new switchboard, instruments, transformers, meters, etc. D. C. Newton is superintendent.

SCHENECTADY, N. Y.—Bids will be received by the Board of Contract and Supply, City Hall Annex, until July 23, for the general construction, including electrical work, for three new schools. Plans and specifications may be secured from W. T. Wooley, city engineer and architect, 447 Franklin Street, Schenectady. Fred E. Johnson is secretary of Board of Contract and Supply.

SPENCER, N. Y.—The Seely El. Co., of Spencer, expects to erect within the next two months 3 miles of transmission line, with distribution system at end, and to purchase switchboard and instruments for same, and material for street-lighting system, including hoods, brackets, etc.

CANTON, PA.—The Canton Illg. Co. expects to erect within the next three months a new brick and concrete power house (30 ft. by 80 ft.) and to install two 150-hp boilers (150 lb. pressure), two 160-hp Skinner engines connected to two 125-kva General Electric, 60-cycle, 2500-volt generators. Contracts have been placed for all machinery. The company is changing its system from direct to alternating-current and will establish a 24-hour service. H. L. Clark is treasurer.

COATESVILLE, PA.—The Chester Valley El. Co., of Coatesville, has recently closed a five-year contract with the borough of Coatesville for street-lighting and is considering the installation of metallic or luminous-arc lamps. The company is erecting a 7-mile high-tension transmission line to Parkersburg, material for which has been purchased. F. W. Harris is superintendent.

DUNBAR, PA.—The Dunbar El. Co. expects to purchase within the next month about 130 poles and crossarms and some incidentals for ordinary upkeep of distribution system. Stuart B. Marshall is general superintendent.

ERIE, PA.—The Erie County El. Co. expects to erect within the next two months additional three-phase transmission lines and to purchase within the next 30 days three 500-kva transformers and also to purchase within the next six months one 5000-kva turbine. The company has bought within the last four months two 550-hp Babcock & Wilcox boilers. T. J. O'Dea is superintendent.

HAMBURG, PA.—The Hamburg Gas & El. Co. expects to purchase within the next three months two 150 or 200-hp boilers. The company has just completed the erection of six miles of 4400-volt transmission line to supply electricity to two boroughs and three villages. A. J. Althouse is superintendent.

HOLTWOOD, PA.—The Pennsylvania Wtr. & Lt. Co., of Holtwood, expects to erect within the next six months a second transmission to Baltimore, Md., consisting of three-phase circuits and to extend the Baltimore substation 44 ft. The company also expects to purchase unit No. 8, consisting of a 17,000-hp water turbine directly connected to a 12,000-kw generator, governor and necessary lubricating system for new unit; switching equipment for new unit at Holtwood station, the two new circuits to Baltimore, one 10,000-kw transformer for Baltimore station for the two new circuits, one 10,000-kw transformer and three 13,000-volt feeders; three 10,000-kw transformers, of which two are for Holtwood station and one for the Baltimore substation, and all material for No. 2 Baltimore transmission line, such as towers, cables, insulators, lightning

arresters. A. Benzon is assistant chief engineer. The offices of the company are located in United States Fidelity & Guarantee Building, Baltimore, Md.

NORTH WARREN, PA.—Work will begin in the near future on the construction of a large power plant at the State Hospital for the Insane at North Warren, to cost $125,000.

PHILADELPHIA, PA.—The United El. Construction Co., of Philadelphia, was recently awarded the contract for electric-lighting equipment, including engines, generators, pumps, wiring, telephones, etc., for the Kenilworth apartment house, at Nineteenth Street and Rittenhouse Square, at a cost of $60,000; also the contract for the entire electrical equipment for the new building being erected for the National Biscuit Co., at a cost of $10,000.

SUNBURY, PA.—The Northumberland County Gas & El. Co., of Sunbury, is erecting a 6-mile extension to its 16,500-volt transmission line from Milton to Watsontown, to supply electricity to brick manufacturing plants there. Material for the above has been purchased. The company expects to purchase within the next 30 days high-tension disconnecting switches for out-door service (33,000 volts). S. G. Reque is superintendent.

YORK HAVEN, PA.—The York Haven Wtr. & Pwr. Co. expects to erect within the next three months a 4500-volt transmission line to Mount Wolf, Pa., and a 2200-volt line to Royalton, and also expects to purchase three 200-kw transformers within the next month. W. L. Mann is general manager.

TRENTON, N. J.—The merchants of this city are reported to be interested in a proposition to start an independent lighting plant. The proposed plant will be built by Ogden D. Wilkinson, of Philadelphia, Pa., one of the large property owners in this city.

CLARKSBURG, W. VA.—The Clarksburg Gas & El. Co., it is stated, is having plans prepared for a central power plant of brick and steel construction, 75 ft. by 85 ft., to cost about $500,000.

WASHINGTON, D. C.—An American consul in Central America has transmitted the name of a person in his district who is interested in electric-light supplies and telephones and who has been requested to submit estimates of cost on an electric-light outfit for two towns. For further information, address No. 11,287, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

WASHINGTON, D. C.—An American consular officer in the Far East has transmitted the names of two electric-light companies in his district which are preparing to construct electric railway lines about 20 miles in length. Correspondence may be in English. Further information may be obtained by addressing No. 11,283, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

WASHINGTON, D. C.—A report from an American consul in England states that a firm in his district desires particulars, including illustrations, prices, etc., from American manufacturers of wireless telegraphy apparatus. The firm is in touch with several ship and trawler owners who own at least 550 vessels. For further information address No. 11,292, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 22 for furnishing at the navy yard, Brooklyn, N. Y., supplies as follows: Schedule 5637, one 30-kw motor generator, 15 5-kw radio sets for ship installation. Bids will also be received until Aug. 5 as follows: Boston, Mass., Schedule 5644, for one three-motor electric traveling crane; Philadelphia, Pa., Schedule 5646, one motor-driven flange facing machine; Norfolk, Va., Schedule 5643, 16 blower ventilating sets; Schedule 5641, rewiring quarters at navy yard; Puget Sound, Wash., Schedule 5623, six heavy pattern, motor-driven engine lathes; Washington, D. C., Schedule 5639, 15 sets transmitting and receiving, etc., radio sets. Applications for schedules should designate the schedule desired by number.

North Central

ALBION, MICH.—The Commonwealth Pwr. Co. will rebuild its local plant, recently destroyed by fire, at once. The city will be without street-lighting service until the plant is rebuilt.

DETROIT, MICH.—The Edison El. Illg. Co. is reported to have awarded contract for the erection of substation building, 40 ft. by 75 ft., one story, at Bellevue and Waterloo Streets. Plans are now being prepared for a substation 40 ft. by 100 ft., to be located at the corner of Beech and First Streets.

DETROIT, MICH.—All bids for the 5000-kw turbo-generator unit for the municipal electric-light plant have been rejected by the Public Lighting Commission and new bids will be asked for. Under the new specifications the lighting commission will lay the foundations. An appropriation of $119,500 has been made for the equipment.

FRANKFORT, MICH.—The new dam of the Benzie County Pwr. Co., on the Betsey River, will be completed early in August, and will develop 1200 hp. This energy will be used for lighting and industrial purposes in the town of Frankfort, Elberta, Benzonia and perhaps other places. S. B. Wiggins, whose address is the Engineering Building, Ann Arbor, is engineer in charge.

HOUGHTON, MICH.—The Board of County Supervisors has entered into a contract with the Houghton County El. Lt. Co. for lighting the county bridge for a period of five years at $825 per year. New tungsten lamps are to be installed on the bridge.

BRYAN, OHIO.—The installation of a new street-lighting system to cost approximately $5,000 is under consideration. The plans provide for the erection of 70 standards on Main Street surrounding the Court House Square.

CINCINNATI, OHIO.—Bids will be received at the office of the clerk of Board of Education, City Hall, Cincinnati, until Aug. 4 for furnishing material and installing electric-lighting systems in the Whittier and Hyde Park public schools, in accordance with plans and specifications on file in the office of C. W. Handman, business manager.

CLEVELAND, OHIO.—Bids will be received at the office of the secretary to the director of public service, 104 City Hall, Cleveland, until July 25, for transformers for the municipal electric light department of Cleveland. Bids will also be received at the same time and place for electric meters for the Municipal Electric Light Department of Cleveland. Plans and specifications may be obtained at the office of the engineer of construction, room 319, City Hall. W. J. Springborn is director of public service and W. H. Kirby secretary.

KENTON, OHIO.—The Hardin-Wyandot Ltg. Co. is building 12 miles of transmission line between Forest and Upper Sandusky, which is expected to be complete within thirty days. P. M. Magly, manager.

MASSILLON, OHIO.—The Massillon El. & Gas Co. expects to increase its transformer capacity on the 11,000-volt transmission line to Canal Fulton by 300 kw, and in Canal Fulton by 100 kw, to care for increased load. The company also expects to purchase within the next month 1000 or 1500-hp feed water heater and feed pump, Lea V-notch recorder for boiler feed water. Generating and street-lighting equipment has not yet been decided upon. J. B. Johnson is superintendent.

TOLEDO, OHIO.—A petition has been presented to the City Council asking for the installation of boulevard lamps on Jefferson Street between Eleventh and Fourteenth Streets. J. R. Crowell is director of public service.

WEST MILTON, OHIO.—L. A. Pearson, owner of the Stillwater Valley electric-light plant, expects to purchase within the next two months one 150-kw alternator and to erect a 5-mile transmission line to a neighboring village within the next six months.

LOUISVILLE, KY.—The Louisville Gas & El. Co., which recently took over the control of all public utilities of Louisville, is reported to be considering plans for the establishment of a central steam heating station. The George G. Fetter Lt., Ht. & Pwr. Co., one of the companies taken over, has a steam heating franchise covering a few of the downtown streets, and some buildings are now being served under it. Additional franchises will be asked in the near future. George H. Harris is president of the Louisville Gas & El. Co.

PINEVILLE, KY.—The Kentucky Utilities Co., of Lexington, is reported to have made arrangements to enlarge its plant at Pineville so as to enable it to furnish electrical service to the coal mines in this section.

BATESVILLE, IND.—The Batesville El. Lt. & Pwr. Co. expects to install within the next two months one 600-hp Heine boiler, one 250-hp Erie City boiler and one 150-hp Tudor boiler and one Heine brick stack (175 ft. high); one Roney-Westinghouse stoker and Cochran heater, and one 500-kw Westinghouse generator, complete with switchboard, the generator to be direct-connected to Hamilton Corliss engine. A. W. Romweber is secretary.

DANVILLE, IND.—Bids will be received until Aug. 1 for heating apparatus, plumbing and wiring of the new court house in Danville. For further particulars address Lewis W. Borders, auditor.

DANVILLE, IND.—The Danville Lt., Ht. & Pwr. Co. expects to erect within the next three months a pole transmission line to Clayton and Pittsboro and to install a post lighting system within the next three months in Danville and Plainfield, provided that in both cases the towns purchase the standards. Harry C. Kahlo is secretary.

GARY, IND.—The Gary Ht., Lt. & Wtr. Co. is installing a 75-lamp mercury-arc rectifier, 6600 volts, and is also extending the ornamental series incandescent lighting system, adding 15 three-lamp and five-lamp posts. Leonard Fitzgerald, superintendent.

GOSHEN, IND.—Contracts will be awarded by the city of Goshen on July 21 for an ornamental street-lighting system. W. A. Brooks is clerk.

HAUBSTADT, IND.—The Zillick & Schaefer Milling Co. now runs its 250-bbl. mill with electricity and furnishes energy for lighting in about 70 residences for which 200 or 300 lamps a year are required.

JASPER, IND.—Recent improvements in the municipal lighting plant have called for the purchase of the following material: One 150-kw and one 250-kw directly connected two-phase, 2300-volt generator with directly connected exciter, one 170-hp and one 300-hp four-valve engine, one seven-panel switchboard, line material and incandescent lamps. By Nov. 1 the plant contemplates installing 24-hour service and will then be in the market for all kinds of heating and cooking apparatus and household labor-saving devices. J. P. Kunkel, superintendent.

MENTONE, IND.—Messrs. Hollands and Davis, owners of the local electric-light plant, expect to purchase within the next two months 12 lamp standards.

OOLITIC, IND.—The local electric-light plant is reported to have been damaged by fire recently, causing a loss of about $5,000.

BARRY, ILL.—The City Council has refused two franchises offered by the Central Illinois Pub. Ser. Co., and it is said that the construction of a municipal electric-light plant is under consideration.

CHICAGO, ILL.—Bids will be received by John McGillen, clerk of the Sanitary of the District of Chicago, until July 24, Room 700, South Michigan Avenue, Chicago, Ill., for furnishing series, alternating-current, enclosed arc lamps, in accordance with specifications, which may be obtained at the above office. Thomas A. Smyth is president of board of trustees, Sanitary District of Chicago.

CLINTON, ILL.—The City Council is contemplating the installation of a municipal electric-light plant at the water works station. Charles Dickerson, commissioner of the Water Works Department, is interested.

LA SALLE, ILL.—The Western Cloak Co. is reported to be contemplating the construction of a power house in La Salle, to cost about $25,000.

LEWISTOWN, ILL.—The Lewistown El. Co. is reported to be considering the question of furnishing electricity to operate the pumps at the municipal water works plant.

MONMOUTH, ILL.—The Commercial Club, in co-operation with the Monmouth Public Serv. Co., expects to establish a boulevard lighting system.

MORRIS, ILL.—The installation of a new street-lighting system in Morris is under consideration by the City Council.

O'FALLON, ILL.—The Southern Illinois Lt. & Pwr. Co., of Hillsboro, has purchased the plant of the O'Fallon El. Lt., Ht. & Wtr. Co. The local plant, it is said, will be dismantled and electricity to operate the local system will be furnished by a transmission line from Collinsville.

DEPERE, WIS.—Material for the installation of the new street-lighting system (mentioned June 21) has been purchased and includes 204 100-watt tungsten and 18 arc lamps. L. L. Tessier, superintendent.

GRAFTON, WIS.—Earlier in the year at Grafton a new series tungsten street-lighting system was put in operation, and the Grafton Lt., Ht. & Pwr. Co. is now furnishing for the city a total of 29 lamps, six being 200-cp, 15 100-cp and 8 80-cp, all 6.6-amp units. August Kroehuke, secretary.

LUCK, WIS.—The local electric-light plant and saw mill, owned by P. M. C. Pederson, is reported to have been destroyed by fire recently, causing a loss of about $8,000.

MARSHFIELD, WIS.—The Water and Light Commission has been authorized to procure estimates of cost for the necessary improvements to the water and light systems.

SEYMOUR, WIS.—S. D. Newell, owner of the local electric-light plant, expects to erect within the next three months a new concrete power house (40 ft. by 66 ft.) and install a new 150-hp boiler and a Bates Corliss engine.

BRAINERD, MINN.—The Minnesota Central Ry. Co., recently incorporated, contemplates the construction of a street railway in this city, in central Minnesota, and the erection of a high-tension transmission line to connect this city with Ironton and other towns on the north Cuyuna Range. R. M. Hughes, Alworth Building, Duluth, is counsel for the company; Joseph Ferrier, of Duluth, William F. Henry and John H. Hill, of Ironton, are incorporators.

NEW PRAGUE, MINN.—The managers of the municipal electric-light plant and water-works system expect to erect within the next four months either a brick or concrete chimney, 80 ft. high, and to purchase one fire-tube boiler, 18 ft. by 66 in., for 130-lb. pressure. Joseph T. Ryan is superintendent.

ROCHESTER, MINN.—The City Utility Board, it is reported, is about to award a contract for the installation of an ornamental street-lighting system. The plans provide for 60 lamps, to cost about $8,000.

ST. JOSEPH, MINN.—The local electric-light plant is reported to have been damaged by a storm recently, causing a loss of about $5,000.

ST. PAUL, MINN.—The State Board of Investment has voted to loan the village of North St. Paul $8,000 to enlarge its water and light plant.

WILMAR, MINN.—The lines of the electric-light plant are being rebuilt throughout the city this summer. A constant-current transformer will be installed within the next month on the series street-lighting system and about 40 ornamental lamp-posts. Clarence C. Haskell is superintendent.

WINDOM, MINN.—The citizens have voted $15,000 bonds for day service. Up to the present time the municipal plant has furnished only night service.

HAWARDEN, IA.—The city of Hawarden is now installing two boilers, two engines, three generators and a complete switchboard and series street-lighting equipment. T. J. Reeves, city clerk.

LAKE MILLS, IA.—J. B. Conley, owner of the local electric-light plant, expects to purchase within the next few months some electrical appliances, including heating and cooking apparatus, vacuum cleaners, etc. A day service was established June 24, 1913.

MARSHALLTOWN, IA.—The Lennox Furnace and the Quick Action Range Companies, it is reported, will use electrically operated machinery in new factories to be erected.

ROCK RAPIDS, IA.—Within the next year two boliers, an engine and a generator will be purchased for the city lighting plant. E. G. Ging, manager.

SIGOURNEY, IA.—The new power house at Sigourney is almost complete and a 350-hp Hamilton heavy-duty Corliss engine and a 300-kva three-phase generator have been purchased. R. L. Van Meter is superintendent and manager.

JOPLIN, MO.—The City Council is reported to have passed an ordinance calling a special election July 22 to submit a proposition to issue $75,000 in bonds for improvements and extensions to the municipal electric-light plant.

MARYVILLE, MO.—The Maryville El. Lt. & Pwr. Co. has just completed the installation of an ornamental street lighting system, consisting of 72 lamp standards, carrying one 100-watt and four 40-watt Mazda lamps. The company has entered into a contract with the city whereby all arc lamps are to be taken out and 100-wat Mazda lamps installed throughout the city where both arc and 40-watt series Mazda lamps have been used. About 180 of the new lamps will be erected. C. C. Hellmers is secretary and manager.

ST. LOUIS, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 29, for a vacuum cleaning apparatus in the United States post office building at St. Louis, Mo., in accordance with plans and specifications, copies of which may be obtained at the office of the custodian, or at the above office. O. Wenderoth is supervising architect.

NELSON, NEB.—The Nelson Lt. & Pwr. Co. expects to purchase within the next two months two oil engines with a rating of from 65 hp to 70 hp.

OMAHA, NEB.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 28 for furnishing air washers and humidifiers, heating and temperature coils for the United States court house, custom house and post office building at Omaha. Specifications may be secured from the custodian of building at Omaha or at the above office. O. Wenderoth is supervising architect.

TECUMSEH, NEB.—The managers of the municipal electric-light plant expect to erect within the next three months 12 miles of transmission lines and will purchase equipment for same; also to purchase within the next two months coal-conveying machinery for 250 ft., and within the next month to purchase 1000 lb. No. 886 weatherproof wire. The management of the plant has just started to handle electrical appliances, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. The village of Cook is contemplating erecting a transmission line from that village to Tecumseh.

VALLEY, NEB.—The municipal electric light commissioners expect to purchase within the next two months two 10-kw transformers and 24 lightning arresters, fifty 100-watt series street lamps and forty 100-watt multiple lamps. Albert P. Hedberg is village clerk.

ATCHISON, KAN.—Bids will be received at the office of W. P. Waggener, for the Atchison Hospital Association, until July 28, for general plumbing, heating and electric wiring contracts for a hospital in Atchison. Plans and specifications may be secured from Sayler & Sedden, architects, Gumbel Building, Kansas City, Mo.

HOLTON, KAN.—Bids for electrical equipment, it is reported, were rejected July 5. Proposals for engine and generator will be received July 25; bids for other equipment will be opened later. Worley & Black, Reliance Building, Kansas City, Mo., are consulting engineers.

JETMORE, KAN.—It is reported that bonds have been voted for the installation of a municipal electric-light plant and water works system.

Southern States

BLACK MOUNTAIN, N. C.—The Black Mountain Tel. Corpn., it is reported, will erect a steam-driven electric generating plant in connection with Dickey-Campbell Lumber Co. The proposed plant will have an output of about 100 hp. F. B. Braid is general manager.

ROCKY MOUNT, N. C.—The Public Works Department expects to purchase within the next two months one 500-kw, 60-cycle, 2300-volt, alternating current turbo-generator, one exciter and one switchboard panel with instruments for above unit. A. S. Lyon is superintendent.

McCOLL, S. C.—Bids will be received by the Public Works Commission and the Sewerage Commission until July 29 for furnishing material and constructing water-works, electric-lighting and sewerage systems, in accordance with plans and specifications on file in the office of the town clerk. Copies of specifications may be secured upon application to J. Newton Johnson, engineer. T. B. Gibson is chairman board of public works.

LAKELAND, FLA.—The municipality is considering issuing bonds for enlarging the electric light plant. H. D. Bassett, chairman water and light commission.

LAKE CITY, FLA.—It is reported that bonds to the amount of $7,500 have been voted for the installation of a new electric-lighting system.

MILTON, FLA.—Bids will be received by S. J. Harvey, president of Council, until July 29, for furnishing material and constructing waterworks, sewer and electric-light systems for the town of Milton, as follows: (1) Water-works system, consisting of two 1,000,000-gal. (per day) pumps; two 125-hp boilers with appurtenances; 100,000-gal. tank, minimum head 100 ft.; approximately 3¼ miles of cast-iron mains 4 to 10 in. in diameter; one 8-in. deep-well, one clear-water well, 40 fire hydrants, valves and boxes. (2) Sewer system, consisting of 4/5 mile of pipe line 8 in. to 10 in. in diameter, with manholes and flush tanks. (3) Electric-light system, consisting of one 100-hp simple engine, directly connected to a 50-kva, 60-cycle, three-phase, 2300-volt generator; suitable switchboard and transmission line with necessary transformers, lighting arresters and series lamps. Proposals will be received as follows: First—for furnishing material and constructing three systems complete; second—for furnishing labor and constructing the systems. The city to furnish material for the entire work or any subdivisions scheduled under the bidding sheet. Plans and specifications are on file at the office of the town clerk of Milton, and at the office of Solomon-Norcross Co., engineers, 1622 Candler Building, Atlanta, Ga. Copies of plans and specifications may be obtained upon application to the engineers, for which a deposit of $10 will be required, to be refunded upon return of plans.

MEMPHIS, TENN.—The Memphis Consol. Gas & El. Co., it is reported, will erect an electric 6600-volt transmission line that will completely encircle the city, in conjunction with the Belt Ry. Co., to furnish electricity for manufacturing plants. The first section (9 miles) will be erected at once, and the remaining 18 miles will be built as soon as business demands it.

SHELBYVILLE, TENN.—The Duck River Pwr. Co., of Shelbyville, expects to install within the next three months two 44-in. Trump water turbines. The company is completing a three-phase transmission line for its power house 3 miles distant. All machinery, including turbines for proposed improvements, has been purchased. A. F. Trimble is general manager.

BIRMINGHAM, ALA.—The Republic Iron & Steel Co., of Birmingham, contemplates the construction of a large electric generating plant at East Thomas, to cost about $100,000. The proposed plant will furnish electricity for the furnaces at Thomas and to operate the machinery at the Sayreton mines and also for three other openings. A high-tension transmission line will be erected between Thomas and Sayreton. Martin J. Lide, of Birmingham, consulting engineer, it is understood, will have charge of the erection of the plant.

BREWTON, ALA.—The installation of an electric-lighting system at the Downing Industrial School is reported to be under consideration.

MERIDIAN, MISS.—The Meridian Lt. & Ry. Co. expects to erect an extension to its power house and put in a concrete steel floor within the next four months and to purchase a 2000-kw General Electric turbine within the next three months. The company has just completed the installation of Murphy stokers under 1500-hp boilers, putting in ash-carrying equipment and new stack. A. B. Paterson is general manager.

NEW ORLEANS, LA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 6, for an electric elevator plant in the United States post office and court house at New Orleans, La., in accordance with drawings and specifications, copies of which may be obtained at the above office or at the office of Hale & Rogers, 11 East Twenty-fourth Street, New York, N. Y., architects. O. Wenderoth is supervising architect.

BAY CITY, TEX.—The Texas Pub. Ser. Co., recently incorporated, is reported to be contemplating improvements to its local plant. The company is controlled by the Albert Emanuel Co., of Dayton, Ohio.

HICO, TEX.—The Hico El. Lt. & Pwr. Co. expects to erect within the next two months about 22 miles of transmission lines and has purchased a 100-kva Curtis turbine and General Electric generator, a Wheeler condenser and Christy vacuum pump, switchboard equipment and transformers, poles, lightning arresters and wire for distribution system. H. Gleason is manager.

Pacific States

ARLINGTON, WASH.—The Jim Creek Wtr., Lt. & Pwr. Co., of Arlington, Wash., has recently erected a substation at its hydroelectric plant for step-up transformers to transform the voltage from 2000 volts to 11,000 volts and will install step-down transformers in Arlington. E. G. Robinson is manager.

BELLINGHAM, WASH.—The City Council has voted in favor of the construction of a municipal electric-light plant, to be built on the Nooksack River. A committee from the City Council, headed by City Engineer North, has been instructed to investigate the proposition.

COLFAX, WASH.—The Washington Wtr. Pwr. Co., it is reported, contemplates extending its transmission lines from Colfax in Whitman County during the summer. The first extension will be from Colfax to St. John, thence to Endicott, via Diamond. The company has been granted a franchise in Endicott.

SEATTLE, WASH.—The Puget Sound Trac., Lt. & Pwr. Co., Seattle, is reported to have applied for franchises in North Seattle, Kirkland and Redmond.

TACOMA, WASH.—The City Council has instructed Nicholas Lawson, commissioner of light and water, to prepare an estimate of the cost of a cluster lighting system to be installed on Pacific Avenue, Commerce Street and C Street, the three principal business streets of the city. Plans are also being prepared for lighting the residence section with cluster lamps.

FOSTER, ORE.—F. B. Knapp, manager of the Hotel Foster, it is said, will install an electric-light plant here. The equipment will include a generator, a 3-kw, 125-volt exciter and 40-kw, 600 r.p.m. motor.

LEBANON, ORE.—The City Council has adopted a resolution whereby the city will enter into a contract with the Lebanon El. Lt. & Wtr. Co. for electrical power. A lighting system will be installed on Main, Sherman and Grant Street, for which bids will soon be received for fixtures and installation.

BERKELEY, CAL.—The Great Western Pwr. Co. of San Francisco is reported to have applied to the City Council for a 35-year franchise to furnish electricity throughout the city. The company now has a franchise in West Berkeley. Guy C. Earl, of San Francisco, is vice-president.

CLOVERDALE, CAL.—The State Railroad Commission has granted the California Tel. & Lt. Co. permission to issue $350,000 in bonds, the proceeds to be used for paying off existing indebtedness and for additions to its system. The commission also authorized the company to purchase the property of the Cloverdale Lt. & Pwr. Co., and to pay $75,000 in cash and $50,000 in preferred stock for same.

ELSINORE, CAL.—The Southern Sierras Pwr. Co., of San Bernardino, will begin work at once on construction of a one-story reinforced concrete transformer building (135 ft. by 50 ft.) to be located on Main Street.

IMPERIAL, CAL.—The City Council is preparing estimates of cost and detail plans for an electric-light plant and distribution system. I. B. Funk and H. N. Dyke are carrying on the preliminary work.

KITTERICK, CAL.—The San Joaquin Lt. & Pwr. Co.'s recent proposed extensions to its plants at Kitterick and Taft will nearly double the rating of these plants.

SALIDA, CAL.—E. M. Gilbert informs us that the Salida Lt., Pwr. & Utility Co. is now building a 500-kw steam-standby station. The old station contained a 120-hp Corliss engine, and there will be added one 500-kw condensing vertical Curtis turbine and 800 hp in B. & W. boilers, complete with necessary auxiliaries. Most of the equipment was moved from the old steam plant at Leadville, nothing new except the exciters being purchaed. The water-power plants are also being overhauled in all details. A new line from the hydroelectric plant at Garfield is being constructed to replace the old line.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & El. Co. has been granted permission by the State Railroad Commission to issue $639,000 in bonds, the proceeds to be used for additions to its plant in San Diego.

SAN FRANCISCO, CAL.—The State Railroad Commission has granted the Great Western Pwr. Co., of San Francisco, permission to operate under franchises previously given in Contra Costa County, particularly in the vicinity of Antioch.

SPRINGVILLE, CAL.—The work of excavating for the power house of the San Joaquin Lt. & Pwr. Co. on the Tule River plant is about to commence. The equipment of the Tule plant will include two 3000-kw Allis-Chalmers generators, with water wheel of sufficient rating to carry a 25 per cent overload working under a head of 1500 ft. There will be four transformers which will step up the voltage to 60,000 to deliver energy to the 60,000-volt line of the San Joaquin loop system.

BOISE, IDAHO.—Bids will be received at the office of the United States Reclamation Service, Los Angeles, Cal., until July 23, for furnishing electrical equipment for the Boise and Minidoka projects, Idaho, including wattmeters, transformers, oil switches, air-brake switch, lightning arresters, etc. For further information address United States Reclamation Service, 605 Federal Building, Los Angeles, Cal., or Washington, D. C. O. H. Ensign is consulting engineer.

COEUR D'ALENE, IDAHO.—A proposition will be put before the taxpayers in the fall for the city either to purchase the existing electric lighting plant or to build a new one.

TWIN FALLS, IDAHO.—The City Council has adopted a resolution calling for the installation of cluster lamps to be erected in the central part of the city.

TUCSON, ARIZ.—The Federal Lt. & Pwr. Co., New York, holding company of the Tucson Gas, El. Lt. & Pwr. Co. and the Tucson Rapid Transit Co., is making a tentative offer to spend about $150,000 in extensions and improvements in the lighting and street railway systems in Tucson, provided the City Council will grant a new contract to the company for lighting at a rate no higher than at present. W. A. Haller, general superintendent and chief engineer of the Federal Company, at 60 Broadway, New York, has outlined these plans.

RAWLINS, WYO.—The Rawlins El. Lt. & Fuel Co. expects to install within the next three months an elevated track on which coal cars (pulled by motor or capstan) will be unloaded from the bottom instead of by hand. The company also expects to install within the next six months one 100-hp, 2300-volt, 60-cycle alternator (directly connected) as relay unit for use in case of emergency. J. H. Jacobucci is engineer of power station.

Canada

CALGARY, ALTA.—A by-law was recently passed authorizing additions to the power house equipment, including gas-fired boilers and turbo-generators with a rating of 6600 hp.

MEDICINE HAT, ALTA.—The City Council, it is reported, has authorized City Engineer Grimmer to place contracts for six 500-kw transformers.

KAMLOOPS, B. C.—The city of Kamloops expects to build a power house on the Barriere River and to erect a transmission line from the power plant to Kamloops, a distance of 40 miles, within the next nine months; it also expects to purchase within the next nine months two waterwheels and two generators with a rating of 1000 hp each, equipment for high-tension line, including step-up and step-down transformers (for 44,000 volts), aluminum cable, high-tension insulators, etc. C. L. Wain is superintendent.

MERRITT, B. C.—Within the next year the city of Merritt will install a second 125-kw, three-phase, 60-cycle, 2300-volt generating unit in the municipal electric plant.

VANCOUVER, B. C.—The Bridge River Co., recently incorporated, it is reported, is contemplating the development of at least 200,000 hp in the Lillooet district, involving an expenditure of about $8,000,000. The plans provide for the construction of a large dam on Bridge River and a tunnel 1¾ miles long through a mountain to an outlet on Seaton Lake. The transmission line will be about 150 miles long and will follow the route of the Pacific Great Eastern Ry. Co. The proposed power house will be located at Lytton, less than 40 miles from the main line of the Canadian Pacific Railroad and the Canadian Northern railways, and the company hopes to supply motive power to both lines. Application for water rights aggregating 100,000 acre-ft. have been made to the Provincial government. W. R. Bonnycastle is engineer for the power company.

VERNON, B. C.—The City Council is considering the question of installing an electric-lighting system on Barnard Avenue, between Mission Street and Railroad Avenue, at a cost of about $10,000. The Council has also approved the proposition of extending the system to the Pleasant Valley Road.

WINNIPEG, MAN.—Tenders will be received by the city of Winnipeg until Aug. 9 for furnishing and installing one 1000-kw motor generator, plans and specifications for which may be obtained from the Board of Control. M. Peterson is secretary.

AMHERST, N. S.—The Maritime Coal & Ry. Co., of Amherst, is reported to be preparing plans for a transformer station, to cost about $5,000. The power house of the company was recently destroyed by fire.

DUNDAS, ONT.—The water and light committee of the Town Council is considering a proposition to illuminate all the approaches to the town. It has been suggested that the Town Council co-operate with the councils of the surrounding municipalities with a view of lighting the rural highways for some distance out.

TORONTO, ONT.—In order to secure an uninterrupted service the Toronto Hydroelectric Power Commissioners have about decided that the city must have an auxiliary steam plant, which will cost approximately $1,000,000. The proposed plant will probably be located on the water front.

WINDSOR, ONT.—R. T. Jefferies, engineer of the Hydro-Electric Power Commission of Ontario, has submitted plans for the ornamental lighting system to the City Council.

DESCHAMBAULT, QUE.—The Deschambault El. Co. expects to erect within the next five months complete equipment for a 3000-hp plant and to purchase wire insulators for a 50-mile transmission system; also to purchase within the next three months three 1000-hp turbines and switchboard equipment for a 3000-hp plant.

CARLYLE, SASK.—Tenders will be received by F. J. Stent, secretary and treasurer, until Aug. 1 for the construction of water works system and electric-light plant as follows: (1) Construction of brick power house and concrete reservoir, and laying approximately 800 lineal ft. of pipe in trenches and relative works; (2) air-lift pumping system; (3) duplex steam pump; (4) furnishing and installing two horizontal return tubular boilers and stack; (5) compound vertical steam engine; (6) generator, exciter and switchboard; (7) poles, arms, hardware, copper wire, transformers and meters; (8) furnishing series tungsten street-lighting apparatus; (9) erection of pole line. Plans and other information may be obtained at the offices of the John Galt Engineering Co., Ltd., at Winnipeg and Calgary. A deposit of $25 will be required on plans for contract No. 1, which will be refunded upon return of same.

GRENFELL, SASK.—The Town Council is contemplating the installation of a municipal electric-light plant. The British Canadian Engineering & Supply Co., Ltd., 122 Phoenix Building, Winnipeg, Man., is consulting engineer.

New Incorporations

OAKES, N. D.—The Oakes Lt. & Pwr. Co. has been incorporated with a capital stock of $50,000 by F. A. Blakeslee, A. P. White, both of Bemidji, Minn., and C. F. Blakeslee, of Oakes.

JOHNSTON, PA.—The Jenner Township Pub. Ser. Co. has been incorporated with a capital stock of $5,000. Headquarters of the company are located in Johnstown.

LEBANON, PA.—The South Annville El. Lt. & Pwr. Co. has been granted a charter with a capital stock of $5,000. The office of the company is located in Lebanon.

HOUSTON, TEX.—The Public Service Co. has been incorporated with a capital stock of $500,000, to construct and operate electric-light and power plants and water works systems in a number of towns in Matagorda, Upshur, Titus and Wilbarger Counties. The incorporators are: Albert Manuel, of Dayton, Ohio; H. A. Van Eaton, Raymond Neilson, C. H. Wilson, R. C. Patterson and W. A. Parish, all of Houston.

ALDERSON, W. VA.—The Alderson Lt. & Pwr. Co. has been incorporated with a capital stock of $25,000 by W. C. Beard, G. K. Gwinn, L. E. Johnson and others.

CHARLESTON, W. VA.—The Gauley Pwr. Co. has been incorporated by J. H. Gaines, R. Kemp Morton, F. R. Hurlburt, G. G. Todd and A. B. Koontz, all of Charleston. The company is capitalized at $250,000 and proposes to construct five dams in connection with proposed hydroelectric plant; dams are to be located at Wood's and Carnifax ferries on Gauley River and near Carnifax Ferry, Shawni's Bridge and Riverside on Meadow River.

WEBSTER SPRINGS, W. VA.—The Webster Springs Pwr. Co. has been incorporated with a capital stock of $50,000 by C. L. Benedum, J. W. White and E. R. Randolph, of Webster Springs; J. S. Rex, of Monongah, and H. Shaw, of Fairmont.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 8, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,066,468. PROCESS AND APPARATUS FOR ELECTRIC WELDING; L. W. Chubb, Edgewood Park, Pa. App. filed Feb. 16, 1912. Welds unlike metals by effecting percussive engagement of the surfaces to be welded and simultaneously applying heat of great intensity.

1,066,475. ELECTRIC-LAMP CUT-OUT; H. S. Dunning, East Orange, N. J. App. filed Aug. 6, 1910. Lamp terminals are separated by thin films of insulating material which are punctured to automatically short circuit the lamps when the filament is broken.

1,066,476. LIGHTNING ARRESTER; W. H. Elliott, Albany, N. Y. App. filed Feb. 18, 1911. For railway signaling circuits; selective plates separated by spark gaps.

1,066,479. ALARM ATTACHMENT FOR REFRIGERATOR DRIP-PANS; A. J. Fiala, Omaha, Neb. App. filed Sept. 12, 1912. Adjustable float to sound alarm at various heights of water.

1,066,484. OZONE GENERATOR; W. O. Freet, Hackensack, N. J. App. filed Jan. 23, 1912. Of small capacity for use in apartments, etc., has hollow perforated electrodes separated by dielectric plates having openings in their centers.

1,066,493. ILLUMINATED ADVERTISING DEVICE; H. Harrold, Chicago, Ill. App. filed July 12, 1912. Cylindrical transparent or translucent shell surrounding a lamp is given rotative movement by the uprising currents of heated air.

1,066,499. INSULATING COMPOUND; G. A. Jacobs, Cleveland, Ohio. App. filed Apr. 8, 1907. Manila gum, asphaltum gum and linseed oil.

1,066,504. ELECTRODE-LEAD FOR VAPOR ELECTRIC APPARATUS; C. A. Kraus & R. D. Mailey, Newton Highlands, and Lynn, Mass. App. filed June 30, 1910. Screen of insulating material surrounds the anode and is in contact with the mercury of which the cathode is composed.

1,066,505. ANODE-SHIELD FOR VAPOR ELECTRIC APPARATUS; C. A. Kraus & R. D. Mailey, Newton Highlands and Lynn, Mass. App. filed Apr. 5, 1912. Has a plurality of perforated partitions.

1,066,507. SYSTEM OF CONTROL FOR ELECTRIC MOTORS; B. G. Lamme, Pittsburgh, Pa. App. filed Sept. 26, 1910. For starting induction motors of large capacity and relatively low voltage.

1,066,513. ELECTRICAL REGULATION FOR ELECTRIC MOTORS; B. McInnerney, Council Bluffs, Iowa. App. filed Aug. 26, 1911. Automatically reduces speed of an induction motor either when acting against or with the load.

1,066,538. AUTOMATIC RAILWAY SIGNAL AND STOP; A. T. Smith, Sioux City, Iowa. App. filed Feb. 11, 1909. Combination of mechanical trip and electrical circuits.

1,066,554. SYSTEM OF ELECTRICAL DISTRIBUTION; H. G. Thompson, Glen Ridge, N. J. App. filed Oct. 20, 1909. Generator supplies given current to charge storage battery and then when charged to predetermined voltage the charging current is automatically decreased.

1,066,570. APPARATUS FOR THE PURIFICATION OF WATER AND OTHER LIQUIDS; M. D. Avery, Kansas City, Mo. App. filed June 1, 1912. Insulating post rotatably mounted in tank and carrying the electrodes.

1,066,580. SPEED REGULATOR FOR ELECTRIC MOTORS; L. Bradley, Milwaukee, Wis. App. filed Mar. 3, 1913. Compressible resistance column and compressing means.

1,066,582. ELECTRIC MOTOR; J. Buckley, Boston, Mass. App. filed Apr. 9, 1912. For operating advertising devices at constant speed. May be run by battery or power circuit, either A. C. or D. C.

1,066,616. MOTOR CONTROLLER; A. J. Horton, White Plains, N. Y. App. filed July 6, 1908. Auxiliary switch removes the field resistance from the circuit until the controlling member or members have been moved to cut out all of the armature resistance from circuit.

1,066,619. POLYPHASE MAGNETIC SEPARATOR; H. L. Isbell, Naugatuck, Conn. App. filed May 3, 1912. Longitudinally reciprocating table or support covering the magnetic core wound with multi-phase windings.

1,066,635. ELECTRIC MOTOR AND PUMP; W. R. MacDonald, Portland, Me. App. filed Jan. 15, 1912. Centrifugal pump disposed intermediate the longitudinally separated stator and rotor parts of an electric motor.

1,066,648. ELECTRICALLY DRIVEN PORTABLE MACHINE;* A. Palmros, Syracuse, N. Y. App. filed Apr. 30, 1910. Locates only the controlling switch on the machine, the rheostat, reel for the wire, etc., being separate so as not to encumber the machine.

1,066,651. ELECTRODE FOR SECONDARY GALVANIC CELLS; H. P. R. L. Pörscke & J. A. E. Achenbach, Hamburg, Germany, App. filed May 1, 1911. Active mass carried in the interstices of a fine mesh metal fabric which is rolled into a cylinder and forced into a perforated metal receptacle.

1,066,674. APPARATUS AND METHOD FOR THE PRODUCTION OF OZONE; J. Steynis, New York, N. Y. App. filed Jan. 20, 1912. Progressively subjects air to a series of electrical discharges while moving in one direction and simultaneously cools air and resultant ozone by action of cooling fluid moving in opposite direction.

1,066,677. ELECTROMAGNET-SWITCH; A. Sundh, Yonkers, N. Y. App. filed May 25, 1906. A resilient abutment between the core and switch to minimize chattering noises of an A. C. electromagnetic multiple switch.

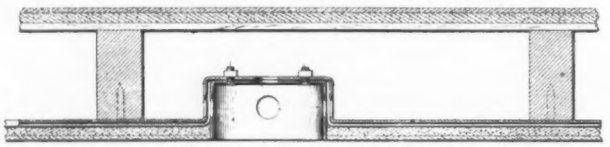
1,066,678. CAR SWITCH CONTROLLER FOR ELECTRIC ELEVATORS; A. Sundh, Yonkers, N. Y. App. filed Aug. 11, 1908. Manual device on the car, which when set for the desired floor, brings car automatically to stop at just the right point.

1,066,681. ELECTRIC CAB SIGNALLING SYSTEM; J. W. Tatum, Angier, N. C. App. filed Mar. 15, 1911. Conductor rail telephone system.

1,066,682. ELECTRIC-WELDING MACHINE; A. C. Taylor, Warren, Ohio. App. filed Aug. 7, 1911. Spot welding machine with swiveled adjustable electrodes.

1,066,706. OUTLET-BOX BRACKET; J. C. Caine, Denver, Col. App. filed Jan. 9, 1912. Arranged to receive the outlet box and to be attached to the wall.

1,066,721. ANTI-REVERSER FOR ALTERNATING CURRENT CIRCUITS; E. L. Gale, Sr., Yonkers, N. Y. App. filed Dec. 5, 1906. Reverses motor connections upon reversal of the main line current so that motor will always operate in the direction desired.



1,066,706.—Outlet Box Bracket.

1,066,726. WELDING MACHINE;* I. H. Gravell, Philadelphia, Pa. App. filed Sept. 24, 1912. Adjustable work-supporting members on the terminals of the machine.

1,066,731. THERMOSTATIC ALARM; F. Jaynes, Des Moines, Iowa. App. filed Mar. 24, 1913. Has a means for manually shutting off the alarm before the temperature has subsided sufficiently for the expansible band to itself break the alarm circuit.

1,066,739. ALTERNATING CURRENT MOTOR CONTROL; D. Larson, Yonkers, N. Y. App. filed Aug. 11, 1908. For elevators; has mechanism for successively short-circuiting the sections of resistance when the controller is started from any position.

1,066,741. SYSTEM OF MOTOR CONTROL; D. L. Lindquist, Yonkers, N. Y. App. filed Aug. 31, 1910. For elevators; to prevent motor attaining unsafe speed and to prevent reverse current in motor field when motor is being driven by the load.

1,066,742. ELECTROMAGNETIC BRAKE; W. D. Lutz, Allendale, N. J. App. filed Feb. 23, 1910. For elevators; automatically effects a slow application of the brake.

1,066,747. POTENTIAL REGULATOR; P. Müller, Charlottenburg, Germany. App. filed Nov. 11, 1912. Rotor with short-circuited winding, stator with two windings at an angle and tap of variable potential at junction of stator windings.

1,066,748. TRAIN-SIGNAL; A. R. Mutton, Waterloo, Iowa. App. filed July 1, 1912. Contact rail system.

1,066,774. MEANS FOR ELECTRICALLY DRIVING MOTOR AGRICULTURAL MACHINES; W. Wortmann, Mainz, Germany. App. filed Oct. 1, 1912. Insulated conductor reeled upon the machine and a bare grounded conductor lying on the ground and connected with machine through movable contacts.

1,066,783. ELECTRIC SWITCH; F. Barr, New York, N. Y. App. filed Apr. 26, 1911. Double pole, double break rotary snap switch.

1,066,786. LOCKING DEVICE FOR TELEPHONES; C. C. Bielitz, Brooklyn, N. Y. App. filed Oct. 11, 1911. Locks the receiver hook against movement.

1,066,787. PROCESS OF PRODUCING ZINC FROM BLUE POWDER; W. F. Bleecker, Canonsburg, Pa. App. filed Jan. 22, 1913. Removes the coating of the particles of blue powder by electrolysis in a fused bath.

1,066,805. ADJUSTABLE IRON CABINET-BOX FOR ELECTRIC-LIGHT-WIRING CUT-OUTS; J. C. Fisher, Denver, Colo. App. filed Nov. 10, 1911. Face of the box is adjustably clamped to the open body position of the box.

1,066,810. THERMAL TREATMENT OF METAL IN ELECTRICALLY HEATED FURNACES; P. Girod, Ugines, France. App. filed Aug. 5, 1909. Effects complete solidification of the melted metal in an electric steel furnace, cools to a temperature as low as incipient red heat and then remelts by electrically generated heat.

1,066,816. JOINTED ROD FOR INSERTING WIRES IN CONDUITS AND ANALOGOUS PURPOSES; J. J. Hess, Chicago, Ill. App. filed Oct. 16, 1911. Pivoted interchangeable rod sections with springs holding the sections normally extended.

1,066,823. ELECTRICAL DISTRIBUTION; R. C. Leake, Baldwinsville, N. Y. App. filed May 10, 1909. Selective-call-telephonic train-despatching system.

1,066,831. ALTERNATING CURRENT MOTOR; A. S. McAllister, New York, N. Y. App. filed Oct. 26, 1909. High-power-factor, non-sparking, single-phase commutator motor.

1,066,833. METHOD OF SMELTING IRON ORES; F. M. McClenahan, Maryville, Tenn. App. filed Apr. 17, 1913. Fluxes aluminiferous iron ores by smelting in the presence of sodium chloride.

1,066,847. LIGHTING ATTACHMENT FOR GAS BURNERS; J. K. Rush, Syracuse, N. Y. App. filed Sept. 22, 1910. Adapted to be clamped to an ordinary gas burner.

1,066,855. PROCESS OF EXTRACTING METALS FROM THEIR ORES; H. B. Slater, Riverside, Cal. App. filed Mar. 13, 1912. Produces a lixiviant by electrolytic means.

1,066,856. THEFT DETECTOR FOR ELECTRIC METERS; J. T. Sloan and A. G. English, Wichita, Kan. App. filed Aug. 31, 1912. When current is attempted to be stolen by shunting the meter, a shunt is established across the live wires which results in blowing of fuses and service being cut off.

1,066,869. HEATING APPARATUS FOR METALLIC TIRES;* W. H. Walker, Somerset, Ohio. App. filed Apr. 9, 1913. Uses gas fuel.

1,066,883. COLLAPSIBLE CABINET; F. F. Burdick, Chicago, Ill. App. filed Nov. 6, 1912. Folding electric light bath-cabinet.

1,066,884. COLLAPSIBLE CABINET; F. F. Burdick, Chicago, Ill. App. filed Feb. 1, 1913. Folding construction of electric light bath-cabinet.

1,066,893. WINDING FOR DYNAMO ELECTRIC MACHINES; C. J. Fechheimer, Cincinnati, Ohio. App. filed Dec. 11, 1907. Two-layer winding for slotted core; the different layers having unequal number of conductors.

1,066,912. FUSE; J. Keefe, Boston, Mass. App. filed Aug. 2, 1912. uses exceptionally long fuse strip; holds window in place by porcelain alone.

1,066,929. ELECTRIC BELL OR ALARM; A. Lüngen, New York, N. Y. App. filed Dec. 24, 1919. A single spring cushions the movement of the armature in either direction.

1,066,961. AUTOMATIC CUT-OUT FOR CLOCK-SYNCHRONIZING MECHANISM; E. A. Hummel, St. Paul, Minnesota. App. filed Aug. 18, 1911. Automatically cuts out the relay from the local circuit which energizes the synchronizing mechanism the moment the synchronizing impulse has been communicated to it.

1,066,963. CASE FOR INCANDESCENT-ELECTRIC-LAMP SOCKETS; A. Weber, Sr., and J. Weber, Schenectady, N. Y. App. filed Jan. 16, 1911. Multiple-lock socket shell.

1,066,964. CASE FOR INCANDESCENT-ELECTRIC-LAMP SOCKETS; A. Weber, Sr., and J. Weber, Schenectady, N. Y. App. filed June 12, 1909. Serrations in edge of one member hold the two parts of a socket shell against relative rotation.

1,066,965. CIRCUIT CONTROLLING DEVICE; F. J. West and H. W. Darby, Winnipeg, Manitoba, Canada. App. filed July 8, 1912. Mercury contact circuit controller for a number of distant tools, such as electrical riveters.

1,066,968. APPARATUS FOR RECOVERING COPPER FROM ITS ORES; H. M. Wilcox, Chicago, Ill. App. filed Aug. 28, 1909. Absorption tank, containing measuring tank for a chemical agent, conduits connecting together the tops and bottoms of the tanks and valves in the conduits.

1,066,995. TILTING METALLURGICAL FURNACE; W. W. Case, Jr., Denver, Col. App. filed Mar. 15, 1913. Periphery of crucible is engaged by plurality of closely-spaced refractory projections.

1,067,003. PROCESS OF MAKING ELECTRICAL CONDUCTORS; W. Deats and C. Scott, Yonkers, N. Y. App. filed Aug. 16, 1909. Mixes finely pulverized carbon and substantially powdered metallic copper, forms into solid block by pressure, and then bakes; for contacts of controllers, etc.

1,067,005. CONNECTION FOR LAMPS OR OTHER ELECTRIC APPARATUS; A. Dénéréaz, Montreux, Switzerland. App. filed Oct. 5, 1909. Separable plug connector.

1,067,016. SOLDER FOR ALUMINUM; C. H. Frantz, New Orleans, La. App. filed Apr. 26, 1913. Made of zinc, tin, lead and aluminum, with the zinc and tin each in excess of the lead and aluminum.

1,067,022. EXTRACTION OF PRECIOUS METALS; W. W. Guest, Alameda, Cal. App. filed Oct. 15, 1912. Grinds ore-bearing sands or ores in a solution of the nitrates, hydrates, chlorates, hyposulphites and hypochlorites of the alkaline metals and subsequently amalgamates by agitation and circulating slimes containing said salts in contact with mercury cathode.

1,067,024. INTERCHANGEABLE ELECTRIC SIGN AND LAMP THEREFOR; F. P. Hall and J. O. Sharpe, Newark, N. J. App. filed Oct. 19, 1912. Lamps carry circuit making points which may be pushed into contact at any point with two wire mesh screens forming the terminals of the circuit.

1,067,031. ELECTRODE FOR USE IN ELECTROTHERMAL PROCESSES; E. B. Jewett, Clarksburg, W. Va. App. filed Feb. 14, 1912. Carbon flour agglomerated by a carbonaceous coke and having distributed throughout its mass relatively large particles of carbonaceous material.

1,067,179. WIRELESS TELEPHONY; V. H. Laughter, Detroit, Mich. App. filed Oct. 20, 1909. Transmitting apparatus.

1,067,191. DYNAMO-ELECTRIC MACHINE; N. Pensabene, Birmingham, England. App. filed Apr. 14, 1913. Rotary converter; regulates leakage flux.

1,067,194. WIRING FOR ELECTRIC-CALL-BELL CIRCUITS; G. A. Pierce, Philadelphia, Pa. App. filed Mar. 24, 1910. Arranged so that sending station may know that operative circuit is completed through receiving station.

1,067,217. ELECTRIC CONTROLLING APPARATUS; W. H. Gaulke, Milwaukee, Wis. App. filed Sept. 26, 1911. Interlocked switch arm construction for controlling speed, etc.

1,067,228. APPARATUS FOR GOVERNING THE PASSAGE OF CARS OR VEHICLES ALONG A RAILWAY AND THE CONTROL THEREOF; L. A. Hawkins, Schenectady, N. Y. App. filed Feb. 23, 1912. Control of A. C. motors for operating switches, etc.

13,591 (reissue). ROTOR-WINDINGS FOR ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINES; L. J. Hunt, Sandycroft, Wales. App. filed June 5, 1913. (Original Patent 1,057,061, Mar. 25, 1913.) Interconnected star and delta connected windings.

13,594 (reissue). ALARM-CLOCK; M. Sheinman, New York, N. Y. App. filed June 5, 1913. (Original Patent 994,542, June 6, 1911.) Sounds an alarm when lock is tampered with.